BLOOD ALCOHOL LEVEL DISCRIMINATION TRAINING WITH SOCIAL DRINKERS

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ABSTRACT

The efficacy of three methods of training male and female social drinkers to estimate their blood alcohol levels (BALs) was investigated. Two groups of subjects were taught to use internal cues or a combination of external and internal cues to estimate BALs during a training session involving alcohol consumption and feedback of actual BAL. A third group of subjects received an information package explaining how external and internal cues can be used to judge BALs, but no training involving alcohol consumption or BAL feedback. Estimation accuracy was assessed both in an experimental setting and the social drinking environment of a student bar.

With training, estimation accuracy increased significantly for all groups and during post training sessions this ability was retained. There were no training or post training differences between groups. Furthermore, male and female subjects did not differ in estimation ability.

The importance of these findings in relation to previous literature is discussed. It is suggested that an information package such as the one investigated here can provide a simpler and more cost effective alternative to traditional discrimination training involving alcohol consumption. The relevance of this finding to alcohol education and prevention programs is emphasised.

CHAPTER 1

INTRODUCTION

1.1 GENERAL INTRODUCTION

The abuse of alcohol in our society constitutes a significant social and health problem. Consequently, the question of how best to deal with this problem, at both treatment and prevention levels, has received much attention.

The decade of the 1960's is significant in the history of the treatment of alcohol problems, as it marked the first major questioning of the dictum that abstinence is the only appropriate goal for treatment. Proponents of this view generally believe that the alcoholic person cannot return to controlled or social drinking because alcoholism is seen to be a disease involving irreversible loss of control over drinking. Jellinek (1960) has provided the most influential statement of this position.

Although this conceptual and treatment approach to alcoholism still remains the most widely accepted by those working in the field, it no longer enjoys the unquestioned acceptance it once had. In the last two decades some researchers have considered a controversial alternative to abstinence, a goal of controlled drinking.

Davies (1962) description of normal drinking in

recovered "alcohol addicts" is often credited with beginning the so called controlled drinking controversy which still continues today. This report not only sparked much controversy, but also stimulated research into the concepts of "craving" and "loss of control" that many considered central to the disease concept.

A direct result of this questioning of the disease model was a variety of attempts to teach alcoholics to control their drinking.

1.2 BLOOD ALCOHOL LEVEL DISCRIMINATION TRAINING: ORIGINS

The blood alcohol level (BAL) discrimination training paradigm was devised by Lovibond and Caddy (1970) who considered the possibility of alcoholics being taught to discriminate (or estimate) their own BAL, then subsequently using this knowledge to keep their BALs below a certain moderate level.

In that investigation 31 outpatient alcoholics were first trained to discriminate (estimate) their BALs within the range of zero to 80mg/100ml of blood, using their "subjective experience" as an aid to BAL estimation. The second phase of the procedure involved aversive conditioning. Subjects were permitted to drink freely until they reached a BAL of 65mg, but above this level they received shocks according to a schedule which maximised uncertainty.

After treatment, follow-up contacts took place at regular intervals over a period of 16 to 60 weeks. Of the 31 alcoholics who entered the program three dropped out, 21 who had drunk moderately during the follow up period were tentatively classed as successes. The seven other subjects were regarded as only partial successes. The alcohol intake of these experimental subjects subsequent to treatment was significantly lower than that of a group of control subjects. This initial study generated considerable interest and a number of investigations of discrimination training followed.

Research concerning the BAL discrimination training paradigm falls into two main categories:

(a) That involving alcohol abusers. Such research has been both experimental and treatment orientated. (e.g., De Ricco, 1977; Ewing & Rouse, 1973; Lansky, Nathan, & Lawson, 1978; Lovibond & Caddy, 1970; Miller, 1978; Silverstein, Nathan, & Taylor, 1974; Strickler, Bigelow, Lawrence, & Liebson, 1976; Vogler, Compton, & Weisbach, 1975; Vogler, Weissbach, & Compton, 1977a, 1977b).

(b) Experimental analyses of the mechanisms involved in discrimination training, using non alcoholic subjects. (e.g., Bois & Vogel-Sprott, 1974; Huber, Karlin, & Nathan, 1976; Lipscomb & Nathan, 1980; Maisto & Adesso, 1977; Ogurzsoff & Vogel-Sprott, 1976).

1.3 BLOOD ALCOHOL LEVEL DISCRIMINATION TRAINING: ALCOHOLICS

In 1973, Ewing and Rouse published a description of an outpatient pilot program to teach alcoholics controlled drinking, which had been influenced by the work of Lovibond and Caddy. The program involved a form of discrimination training in which subjects were required to associate internal sensations with particular BALs, and aversive conditioning.

Ewing and Rouse (1973) report that of 21 patients who participated in the study only six completed the 12 session program. A follow up indicated that only three patients were controlling their drinking, and they were among those who had completed 12 sessions. One patient who completed 11 sessions showed more control than he had previous to the study. All others continued to exhibit serious alcohol problems. Ewing and Rouse state, "we do feel, nevertheless, that the method holds promise". (p.72).

Silverstein et al. (1974) examined the discrimination training paradigm in an experimental study with four male "gamma" alcoholics. Subjects were taught to estimate their BALs using feedback on actual BALs and subjective internal sensations as cues. Aversive conditioning was not included in the procedure.

Contrary to the results of Lovibond and Caddy (1970), the alcoholic subjects in this study could only maintain a satis-

factory level of estimation accuracy when receiving BAL feedback.

Using a discrimination training and electrical aversion method similar to that of Lovibond and Caddy (1970), DeRicco (1977) was able to produce a significant reduction in the rate and frequency of drinking in eight alcoholics. These subjects learned to estimate their BAL to within 10mg of their actual BAL.

Follow up "booster sessions" were scheduled at two, six, 12 and 18 month intervals following treatment. Retention of BAL estimation ability was tested in these sessions. Of the eight alcoholics involved in the study, four participated in one session, one subject participated in two sessions and two subjects participated in four sessions. One subject chose abstinence during the treatment program and thus was not included in the assessments of estimation accuracy retention. The BAL estimates of all subjects remained within 10mg of actual BAL during these booster sessions. DeRicco (1977) concluded that these results demonstrated the viability of a controlled drinking approach in the treatment of alcoholics.

A sample of problem drinkers was used by Miller (1978) to compare the effectiveness of three controlled drinking therapies; aversive counter conditioning, behavioural self control training, and a controlled drinking composite which included discrimination training. Subjects were taught to

estimate BALs using both internal and external factors as cues. No significant differences were found between groups on the outcome measures of mean weekly peak BALs and alcohol intake. Significant reductions were recorded for all groups.

Roger Vogler and his colleagues have investigated the utility of several techniques in altering the drinking behaviour of problem drinkers, inpatient and outpatient alcoholics (see Vogler et al., 1975; Vogler et al., 1977a, 1977b). The above three groups of subjects were exposed to; discrimination training, aversion training, alternatives training and behaviour counselling, avoidance practice, alcohol education, and confrontation by video tape of intoxicated behaviour, in various combinations. Discrimination training emphasising internal cues was used for the alcoholic subjects (Vogler et al., 1975) and both internal and external cues for the problem drinkers (Vogler et al., 1977a, 1977b).

Follow up data collected at 12 and 18 month intervals showed similar improvement in all three groups, on measures of drinking behaviour and alcohol consumption. Vogler et al. (1977b) concluded that discrimination training was a technique with great potential.

Treatment programs involving discrimination training have often incorporated aversive conditioning methods (e.g., DeRicco, 1977; Ewing & Rouse, 1973; Lovibond & Caddy, 1970; Miller, 1978; Vogler et al., 1975, Vogler et al., 1977a, 1977b). However, the Miller (1978), Vogler et al. (1975) and Vogler et al. (1977a, 1977b) studies also demonstrate that non aversive methods can be used to change alcohol related behaviour. This is also shown by Strickler et al. (1976) who describe a treatment method including discrimination training and utilising various positive behavioural techniques.

The success that treatment programs incorporating discrimination training have claimed in producing controlled drinking in alcohol abusers seems to indicate that discrimination training involving internal cues provides such people with the ability to monitor BALs and thus control alcohol intake. However, the results of Silverstein et al. (1974) and Lansky, Nathan, and Lawson (1978) show that the efficacy of using internal cues alone to train alcohol abusers in BAL discrimination is not clearly established.

Lansky, Nathan, and Lawson (1978) investigated the effect of external and internal cue training on the BAL discrimination ability of alcoholics. A discrimination training session significantly increased the accuracy of both groups over pretraining accuracy levels. In the testing session however, only the group given external cue training continued to estimate accurately. Lansky, Nathan, and Lawson

(1978) concluded, "the alcoholic subjects of this research did not learn to discriminate BAL on the basis of internal feelings and sensations nearly as adequately as they did when they referred to external ones" (p.953).

Methodological problems are cited by Maisto and Adesso (1977) and Lansky, Nathan, and Lawson (1978) as making it difficult to establish the validity of some results suggesting that alcoholics can learn to estimate BAL effectively using internal cues. In neither the Lovibond and Caddy (1970), nor the Vogler et al. (1975) studies was there pre or post training assessment of discrimination accuracy. This criticism may also apply for the studies of Ewing and Rouse (1976) and Strickler et al. (1976) who do not indicate in their reports whether pre and post training measures of discrimination ability were taken. In the DeRicco (1977) study, although post training tests of discrimination accuracy were carried out, it is not clear if discrimination ability was assessed prior to training.

A critical issue for the discrimination training treatment concept, concerns evidence that chronic alcohol intake leads to tolerance to alcohol (Maisto & Adesso, 1977). Several researchers have noted that development of tolerance may hinder BAL discrimination at lower BALs by impairing the perception of the internal cues associated with these BALs (e.g., Caddy, 1978; Huber et al., 1976; Maisto & Adesso, 1977; Lipscomb & Nathan, 1980).

Lipscomb and Nathan (1980) tested the tolerance hypothesis by analogy, using non alcoholic subjects. The relationship between BAL discrimination and factors such as behavioural tolerance to alcohol, alcoholism in the family history, and pattern of drinking, (heavy or light) was examined. An internal cue training method similar to that of the Lansky, Nathan, and Lawson (1978) study was used.

It was found that estimation accuracy did not vary with drinking pattern or family history. However, when subjects were grouped as "low tolerant" or "high tolerant" according to performance on a standing steadiness task, subjects in the low tolerance group were more accurate in their estimation. Lipscomb and Nathan (1980) state, "the current finding that low tolerance is associated with estimation accuracy suggests that the high tolerance characteristics of alcoholics may interfere with estimation accuracy" (p.575).

Support for this view is provided by the results of Lansky, Nathan, Ersner - Hershfield, and Lipscomb (1978) who examined the estimation accuracy of alcoholics and social drinkers who had not received discrimination training. The results showed the group of alcoholics to be less accurate than the group of social drinkers.

A long term follow up (27-55 months) of subjects by Ewing and Rouse (1976) showed that while all patients who participated in at least six sessions developed accurate BAL estimation and controlled their drinking during treatment,

all eventually reverted to drinking without control. Ewing and Rouse concluded that they could not justify the use of this treatment with alcoholics again. Furthermore, they suggest the lack of comparable long term follow ups on other supposedly successful programs involving discrimination training, may mean claims of success are unwarrented.

It would appear then, that on the basis of Lovibond and Caddy's work, discrimination training was welcomed as a treatment innovation and subsequently incorporated in treatment programs without the rigorous experimental examination that should precede such an application.

Nevertheless, Lansky, Nathan, and Lawson (1978) and Lipscomb and Nathan (1980) recommend that if discrimination training is to be used in the treatment of alcoholics it should consist of external cue training.

Maisto and Adesso (1977) however, believe that discrimination training may have more potential in the area of prevention programs. Caddy (1978) proposed that those who drink and drive could be given discrimination training. Such an application is described in two recent reports of programs for convicted drunk drivers that include a form of discrimination training (Brown, 1980; New South Wales Bureau of Crime Statistics and Research, 1982).

When the issues mentioned above and the controlled drinking/abstinence controversy are considered, it appears

that if any widespread acceptance and application of discrimination training occurs, it will be in the area of prevention and education rather than treatment.

1.4 BLOOD ALCOHOL LEVEL DISCRIMINATION TRAINING: SOCIAL DRINKERS

Contrary to results with alcoholics, experimental studies of discrimination training involving social drinkers are more conclusive in demonstrating that such people can learn accurate BAL estimation with internal cue training (e.g., Bois & Vogel-Sprott, 1974; Huber et al., 1976; Lipscomb & Nathan 1980; Ogurzsoff & Vogel-Sprott, 1976).

Maisto and Adesso (1977), however, found that their "non alcoholic" subjects did not learn accurate BAL discrimination with internal cue training. They note though, that methodological issues may have contributed to this. The subjects who received drinks containing no alcohol and false BAL feedback may have attempted to use external cues gained when watching drinks being poured, in the absence of any internal signs of intoxication. If these false external cues were not presented it is possible those subjects would have learned accurate discrimination. Given such false external cues they may have responded to the demand characteristics of the situation.

Bois and Vogel-Sprott (1974) describe a procedure designed to teach nine social drinkers to identify their BALs accurately and to monitor, or "self titrate" alcohol intake

to reach a self specified level within the range of 40mg-60mg. Internal cue training was used. During three self titration sessions subjects preselected a target BAL, then drank their preferred drink and monitored their alcohol intake and internal sensations in an attempt to achieve that level. The results showed that by the final session discrimination accuracy was such that the subjects mean BAL estimation error score was less than 10mg.

A very similar procedure was used by Ogurzsoff and Vogel-Sprott (1976) to investigate whether social drinkers with a wide range of drinking habits could successfully learn discrimination skill. Subjects were classified as light or heavy drinkers on criteria of usual amount per drinking occassion and frequency of drinking. Estimation accuracy was found to be significantly greater than pre-training accuracy on all postraining sessions. Age and drinking habits bore no relation to this accuracy, a result consistant with that of Lipscomb and Nathan (1980).

Huber et al. (1976) demonstrated that 36 social drinkers could estimate BALs equally well when trained to attend to internal cues, external cues or a combination of both. Subjects in all three training groups improved in estimation accuracy over pretraining levels. There were no significant differences between groups in either the training or testing sessions.

1.5 RESEARCH ISSUES

The literature discussed above represents the bulk of BAL discrimination training research. If it is examined closely it is clear that there are a number of issues relating to the acquisition of discimination skill which require further investigation.

Blood Alcohol Level Estimation and Social Drinking

Crucial to the validity of the discrimination training paradigm is the belief that, if people learn to estimate their BALs accurately this will facilitate self monitoring to avoid the excessive consumption of alcohol in social situations (Bois and Vogel-Sprott, 1974).

In general, research to date shows that accurate BAL estimation (to within $\pm$ 10mg of actual BAL in several studies) can be achieved in an experimental environment or simulated bar setting. It is implied that there will be generalisation of this newly acquired skill to social situations. To the author's knowledge, however, there has not been a test of this assumption by following training with a test of estimation ability in an actual social drinking setting.

As Rowan (1978) points out, in a social drinking situation the conditions are, in all probability, not as favourable to accurate discrimination. Concentration on such a task may be subject to distraction from a variety of environmental factors, thus making accurate estimation difficult. In past research it appears that this possibility has

been overlooked.

Bois and Vogel-Sprott (1974) claim they have tested the generalisability of discrimination skill in situations where subjects' internal sensations remained the only constant factor. In that study the external factors held constant in the first three sessions (e.g., beverage type, and amount) were changed during the three self titration sessions.

In essence, however, they have merely tested the generalisability of discrimination skill by altering such factors within an artificial experimental setting. Their results do not demonstrate that accurate discrimination is possible in a social setting. The same criticism can be applied to a similar study carried out by Ogurzsoff and Vogel-Sprott (1976).

It is assumed that the discrimination training component in the treatment studies of DeRicco (1977); Lovibond and Caddy (1970); Miller (1978); Strickler et al. (1976); Vogler et al. (1975); Vogler et al. (1977a, 1977b) aided any gains subjects made in controlling their drinking, subsequent to treatment.

However, it has not been demonstrated that subjects in these studies:

(a) could accurately estimate BALs in a social setting.
(b) retain this ability in social situations over time

(though DeRicco, 1977, showed that in follow up booster sessions discrimination ability was retained).

Therefore, post treatment success in controlling drinking could be attributable to treatment components other than discrimination training, or even to non treatment variables.

Retention of Estimation Ability

The evidence available does not clearly establish whether long term retention of this skill is possible. Three experimental studies have included one post training assessment of discrimination ability (e.g., Huber et al. 1976; Lansky, Nathan, and Lawson, 1978; Lipscomb & Nathan, 1980) which has ranged in occurence from one day to two weeks after the training session. Although the studies of Bois and Vogel-Sprott (1974) and Ogurzsoff and Vogel-Sprott (1976) show that discrimination accuracy is retained in three post training sessions, it is not clear when these occured in relation to the training session.

Clinical studies involving alcohol abusers generally describe follow ups, but these have usually not involved reassessing discrimination ability. Vogler et al. (1975) and Vogler et al. (1977a, 1977b) describe follow ups of 12 and 18 months, involving booster training sessions during the first 12 months. However, it is not stated whether discrimination training was involved in these sessions, and furthermore no data from them is presented.

The only evidence of long term retention of estimation ability is provided by Ewing and Rouse (1976) and DeRicco (1977). Subjects in the DeRicco study participated in booster sessions involving assessment of estimation ability at two, six, 12 and 18 months following training. Of the eight alcoholics involved in the study, four participated in one session, one in two sessions, and two in four sessions. One subject chose abstinence during treatment and was not included in the booster sessions. All estimates subjects made were within $\pm$ 10mg of actual BAL.

A follow up ranging from 27-55 months is described by Ewing and Rouse (1976). All subjects were offered "refresher treatments", but only six of the nine subjects who attended the full course of 12 sessions made use of them. Ewing and Rouse state:

> During the treatment sessions, all the patients who came six or more times developed a good capacity to estimate their blood alcohol concentration accurately. It was rare for such subjective evaluation to err by more than 5 to 10mg per 100ml from the actual Breathalyser reading (p.131).

Even if one concludes from these two studies that long term retention of estimation accuracy is possible, such a conclusion can only be made with reference to an experimental setting: retention of discrimination ability has yet to be tested in a social setting.

Training Method

The results of studies carried out so far do not permit clear conclusions to be drawn regarding the efficacy of external or internal cue training. While there is evidence to the effect that social drinkers can learn to estimate BALs on the basis of both internal and external cues, the Silverstein et al. (1974) and Lansky, Nathan, and Lawson (1978) studies show that for alcoholics external cue training is probably best. However, the efficacy of these training methods in relation to estimation ability in social situations is not clear.

In a review of the discrimination training literature, Caddy (1978) states that, "It seems valuable to obtain a clearer understanding of the relative influence of internal and external cues in BAC* discrimination than has been provided by any of the preceding studies" (p. 124). He suggests that such knowledge would be important for developing prevention programs involving discrimination training.

An important consideration here is the fact that in the natural environment there will always be both external and internal cues available to a drinker, and in a social drinking environment people will probably use both to estimate their BALs (Maisto & Adesso, 1977).

Much of the research to date has not considered this. The focus instead has been on whether internal cues can be used successfully to discriminate BALs (Maisto & Adesso, 1977). Indeed in several studies there has been an attempt

* blood alcohol concentration

to limit the external cues available to subjects during training, using such methods as concealing the alcohol content of drinks (e.g., Bois & Vogel-Sprott, 1974; Huber et al., 1976; Lansky, Nathan, and Lawson, 1978; Lipscomb & Nathan, 1980; Maisto & Adesso, 1977).

Since both external and internal cues are available to drinkers in social situations, as Maisto and Adesso (1977) point out, it would seem advantageous in any application of discrimination training to demonstrate that both types of cues can be used to estimate BALs accurately.

Training Environment and Procedures

In general the training methods and setting of discrimination training programs produce an environment divorced from the setting and manner in which people usually drink.

As mentioned previously, in some programs the amount of alcohol consumed has been disguised, when in the natural environment this is not the case. In the Lipscomb and Nathan (1980) project subjects left their individual rooms only when required and social interaction and physical exercise were limited. Maisto and Adesso's (1977) subjects were asked to minimise their movements and not to smoke or read during sessions.

In other studies training has been conducted on an individual basis, subjects drinking alone (e.g., De Ricco, 1977; Ogurzsoff & Vogel-Sprott, 1976, - though subjects were tested

in pairs in the self titration sessions of this experiment). If responsible social drinking is an aim, solitary drinking is hardly appropriate.

Some programs have used simulated bar settings, however (e.g., De Ricco, 1977; Maisto & Adesso, 1977; Silverstein et al., 1974; Strickler et al., 1976; Vogler et al., 1975; Vogler et al., 1977a, 1977b).

Ewing and Rouse (1973) conducted group sessions in a room resembling a living room. Where possible spouses were present. During sessions therapists occasionally drank with the patients, providing them with a model of acceptable social drinking.

It is important that a procedure such as that of Ewing and Rouse (1973), approximating a social drinking situation, be used in preference to one which is far removed from normal drinking practices, if one wishes to maximise generalisation of training to everyday life.

In three studies (Huber et al., 1976; Lansky, Nathan, and Lawson, 1978; Lipscomb & Nathan,1980) BAL estimates were not made on the mgs of alcohol/100ml of blood scale. In the case of Huber et al. (1976) and Lipscomb and Nathan (1980) a scale where zero represented "cold sober" and 50 represented "very high" was used. For the Lansky, Nathan, and Lawson (1978) investigation a similar scale was used, the difference being that the upper limit was 150 (representing "very high")

rather than 50. When given, feedback was converted to this scale. In addition the programmed learning booklet describing BAL-alcohol dose relationships for subjects receiving external cue training in the Huber et al. (1976) and Lansky, Nathan, and Lawson (1978) experiments was also expressed in terms of this scale.

Conversion of BALs to such a scale is imprecise and unnecessary. Using the mg alcohol/100ml blood scale is simpler and more appropriate, given that most information published about alcohol refers to this scale, as does the legal definition of intoxication.

It is possible that a methodological feature of certain studies affects the validity of their results. Caddy (1978) has suggested that the increase in estimation accuracy across sessions in the Bois and Vogel-Sprott (1974) study may reflect recall of BALs achieved in previous sessions, rather than a training effect, because alcohol doses were not varied across sessions. This also applies to three other experimental studies (Huber et al., 1976; Lansky, Nathan, and Lawson, 1978; Maisto & Adesso, 1977).

The validity of this criticism itself is not clear, however. In the Bois and Vogel-Sprott (1974) and Ogurzsoff and Vogel-Sprott (1976) experiments alcohol dosage was not varied in the first three sessions, yet in the last three

sessions when it was self determined, estimation accuracy continued to increase.

Discrimination Training and Women

Jones and Jones (1976) have noted that, "there is scant scientific literature relating to women and alcohol because the preponderance of experimental studies related to acute and chronic effects of alcohol have evaluated only male participants" (p.103).

There is little to counter this assertion in the discrimination training literature; few of the studies reported here have even included female subjects. Females have not participated in any of the experimental studies using alcohol abusers or social drinkers as subjects (e.g., Bois & Vogel-Sprott, 1974; Huber et al., 1976; Lansky, Nathan, and Lawson, 1978; Lipscomb & Nathan, 1980; Maisto & Adesso, 1977; Ogurzsoff & Vogel-Sprott, 1976). They have, however, participated in treatment programs with a discrimination training component (e.g., DeRicco, 1977; Ewing & Rouse, 1976; Lovibond & Caddy, 1970; Miller, 1978; Vogler et al., 1975; Vogler et al., 1977a, 1977b). Males far out number females in all of these investigations however.

Furthermore, no consideration has been given to the possibility of sex differences in estimation ability. This possibility cannot be discounted though, as Jones and Jones (1976) found that the peak BALs of females taking the same alcohol dose on each drinking occasion, varied during the menstrual cycle. Highest BALs occured during the pre menstrual

time.

According to Jones and Jones (1976) it appears that for men there is little variation in peak BAL on different drinking occasions, when the same alcohol dose is taken. Unfortunately, the data from one male only, tested weekly over a three month period is presented to support this hypothesis. For Jones and Jones (1976), however, the implication is that "males may be able to adequately predict their blood alcohol levels from time to time" (p.113).

While it remains speculation at present due to lack of relevant research, the possibility that females will have difficulty in estimating BALs accurately because of BAL variability during the menstrual cycle should not be overlooked.

Training Involving Alcohol Consumption

Caddy (1978) has suggested it may be possible to develop and maintain accurate BAL estimation without discrimination training, "by providing a drinker with a specific profile representing the parameters of his own BAC changes derived from previous experience relating his BAC to specific external drinking cues" (p.126).

There is some evidence that improvements in alcohol related behaviour, equal to that achieved with techniques involving direct therapist intervention, can be achieved with educational material and minimal therapist contact (e.g., Miller, Gribskov, & Mortell, 1981; Miller & Taylor, 1980;

Vogler et al., 1975, Vogler et al., 1977a, 1977b). Considering these results and the logistics of discrimination training (i.e.the expense in terms of equipment, time, and personnel required), such a course of action appears to be a viable alternative to discrimination training and worthy of further investigation.

1.6 AIMS OF THIS INVESTIGATION

The preceding discussion of research issues in the discrimination training literature indicates several areas where there is a need for further investigation, if this technique is to be used effectively in the treatment of alcohol problems, or as a component of prevention and education programs.

Bearing in mind these issues, the aims of this investigation are:

1. To compare the efficacy of three forms of discrimination training,
   - (a) Internal cue training.
   - (b) Combined external and internal cue training.
   - (c) An education package providing the same information given in (b), but with no training involving drinking or BAL feedback.

2. To test the generalisation of this skill to a social drinking setting which is as realistic as possible.

3. To establish whether the ability to estimate BAL accurately is retained over time.

4. To provide data relating to the BAL discrimination ability of women.

5. To provide the subjects taking part in the experiment with a skill which will be of practical use to them in terms of their own alcohol related behaviour.

In this study three groups of social drinkers are exposed to three forms of discrimination training, and the subsequent estimation ability of these groups compared in both the experimental setting and a social drinking environment. Of particular interest is a comparison of the estimation ability of the group receiving information only with the other two groups, and estimation ability in a social drinking environment.

1.7 HYPOTHESES

The following hypotheses will be tested:

1. Discrimination training will produce BAL estimation significantly more accurate than pretraining estimation.

2. There will be a difference between the three training groups in post training assessments of estimation accuracy.

3. Post training assessments of estimation accuracy in a social drinking setting will show that:

(a) estimation accuracy is maintained over time.

(b) the level of estimation accuracy demonstrated in the experimental setting following training, will be maintained in a social drinking setting.

CHAPTER 2

METHOD

2.1 SUBJECTS

The subjects participating in this study were 24 university students (12 males, 12 females). The majority (18) were psychology students, the remaining six were from the university at large. Subjects ages ranged from 20-28 years with a mean of 21 years.

Prospective subjects were administered a questionnaire concerning their drinking behaviour, psychological and physical health (see Appendix A).

To be eligible to participate in the study subjects had to meet the following criteria:

(a) be a minimum of 20 years of age (20 being the legal drinking age).

(b) have no present medical or psychological condition which could be adversly affected by consumption of alcohol.

(c) show no evidence of problem drinking, as indicated by Section A of the questionnaire on drinking behaviour (see Apparatus; Appendix A).

Persons who usually did not drink or who drank less than once a week were not included in the study.

Those people selected to take part were required to sign a statement of responsibility acknowledging their awareness that the experimental procedure required consumption of amounts of alcohol that could raise their BALs above the legal driving limit (80mg). Transport was available to take subjects home after each session if their BALs did rise above 80mg.

The height and weight of subjects were measured on the University's Student Health Service equipment in all cases but one, where a chemist's equipment was used.

All 24 subjects participated in sessions 1-4; session 5 involved 21 subjects. Two subjects were not available for session 5 due to other commitments, and one subject was excluded from participation when an initial breath test before the session revealed his BAL to be above zero.

Following session 1 and prior to session 2, subjects were divided into three groups of eight (four males, four females), matched on pre training BAL discrimination accuracy.

2.2 EXPERIMENTERS

Three experimenters were involved in the study, the author and two female post graduate psychology students, who acted as assistants. The author and one assistant carried out the experimental procedure on all occasions. Initially it was hoped that assistants blind to the specific aims of the study would carry out the entire procedure, but this was not

possible.

2.3 APPARATUS

Measurement of Blood Alcohol Levels

Blood alcohol levels (in mg/100ml blood) were determined from breath samples, using a Lion Alcolmeter S-D2, manufactured by Lion Laboratories Ltd. Cardiff,U.K.

Information Pamphlet (see Appendix B)

This contains a variety of information concerning alcohol and its behavioural and physiological effects. In particular, the relationship between BALs and alcohol intake is explained. Included in the pamphlet are questions designed to test understanding of this relationship, that the subjects were required to answer.

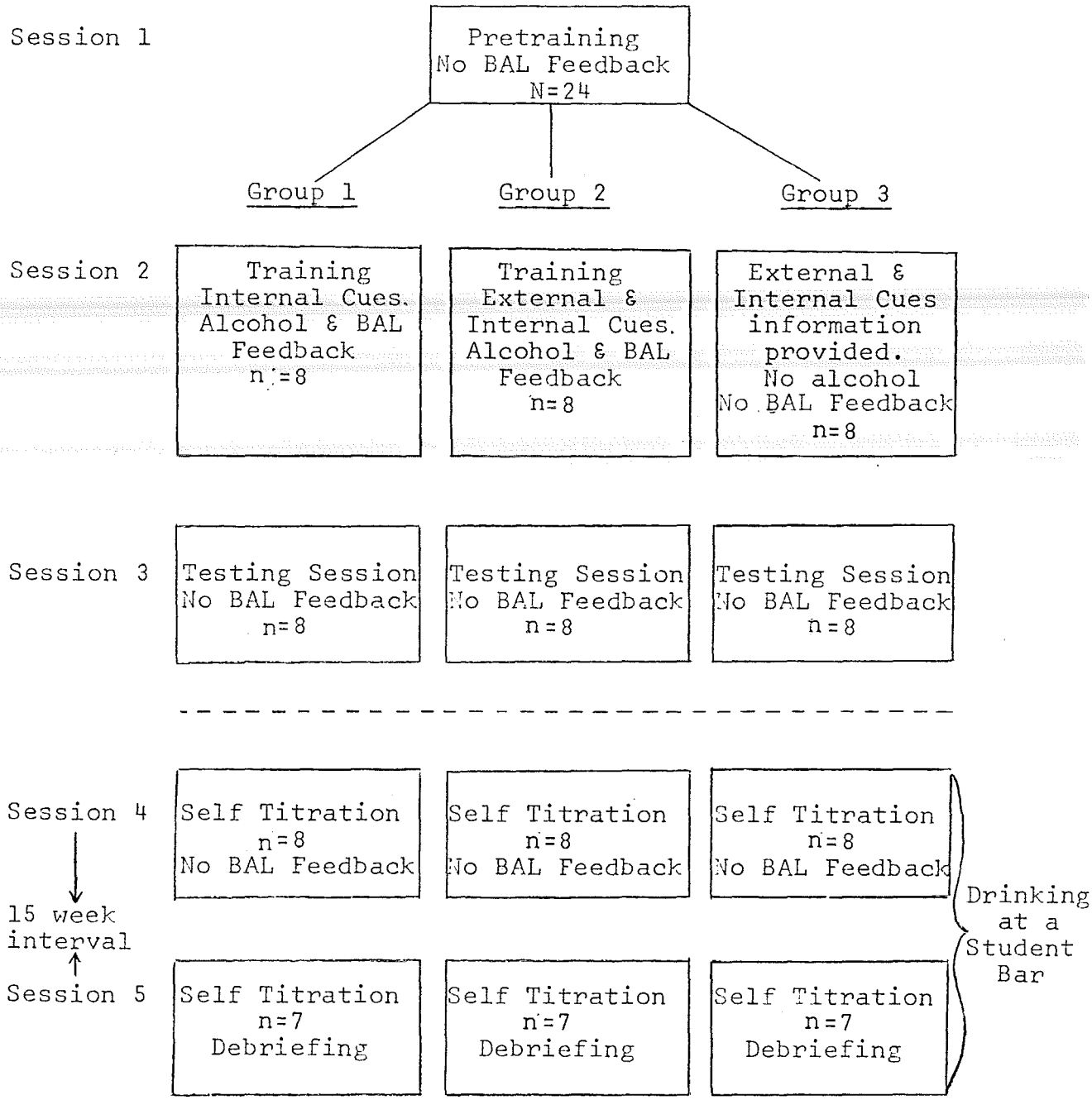
The approximate rate of increase in BAL per hour in relation to the number of drinks consumed, described in the pamphlet, was individualised for each subject in Group 2 (combination of external and internal cue training), based on each subjects computer projected BAL table (see Appendix C).

For subjects in Group 3 (information only) standard rates of increase in BAL per hour of 10mg for males and 15mg for females were used.

Questionnaire on Drinking Behaviour (see Appendix A)

This two section questionnaire served as an aid to the selection of subjects.

FIGURE 1. EXPERIMENTAL DESIGN



Section A contains questions from the Canterbury Alcoholism Screening Test (CAST): the CAST was developed to aid in the detection of people with alcohol problems (Elvy & Wells, in press).

Questions in Section B provided further information regarding drinking habits and subject selection criteria.

2.4 PROCEDURE

The experiment involved five sessions: a pretraining session; a training session; a testing session; and two bar sessions. (See Figure 1). During the two bar sessions subjects drank and mixed with other students at one of the student bars on campus.

Testing Groups

Initially it was planned to test subjects in sub groups of four during sessions 1-3, both for convenience and in order to approximate a social drinking environment. Due to subject availability this was not always possible, and testing groups ranged in size from three to five persons.

Practical considerations necessitated larger testing groups for sessions 4 and 5, thus it was planned to test two groups of 12 subjects in each of these sessions. Problems with subject availability caused alteration of this plan in session 5 when group numbers were 12, six and three subjects respectively.

Subject availability also caused alteration of the proposal that for each subject sessions 1-4 be held at weekly intervals. Consequently the interval between these sessions for individual subjects ranged from one to 13 days.

To test retention of estimation accuracy over time, session 5 was scheduled 15 weeks after session 4.

2.5 SETTING

All sessions took place in the university Students Union building.

Sessions 1-3

Two lecture/meeting rooms were used. Both are multi-purpose rooms used for meetings, student club functions or lectures. On the rationale that the training environment should be as similar as possible to social drinking situations (to facilitate generalisation of training to such situations); music and playing cards were provided and an informal atmosphere encouraged. Subjects were free to discuss whatever they wished, with the exception of matters pertaining to their part in the experiment.

Sessions 4 and 5

Drinking took place at one of the Students Association bar sessions for all but three subjects in session 5, for whom drinking took place at a similar bar evening in the Students Association ballroom.

The Students Association runs bar sessions, usually

between the hours of 4pm and 7pm on Thursday and Friday evenings, during term time. The environment of these bar sessions or evenings is similar to that found in other bars open to the public as the photo in Appendix D shows.

2.6 INSTRUCTIONS TO SUBJECTS

During the initial briefing at the commencement of session 1 subjects were told they were to take part in an experiment investigating the ability of people to estimate their blood alcohol levels (BALs).

Concerning BALs, subjects were informed that the legal definition of intoxication is 80mg/100ml blood; that the present study was concerned with the perception of moderate BALs; and that BALs of above 150mg would not occur.

Prior to each session the following instructions were repeated to the subjects by the experimenter:

(a) Not to eat for minimum of 2.5 hours before the session.
(b) Not to consume alcohol or other drugs for a minimum of 12 hours before the session.
(c) Not to discuss their part in the experiment with other participants until its conclusion.

2.7 INITIAL BREATH TEST

Subjects were given an initial breath test at the commencement of all sessions to ensure that BALs were zero.

One subject was excluded from participation in session 5 when the initial breath test revealed that his BAL was not zero.

Due to assistant error four subjects in session 3 were not given an initial breath screening. However, all four stated they had not been drinking, and this was supported by the results of the first breath test after commencement of drinking.

2.8 BLOOD ALCOHOL LEVEL ESTIMATION

Subjects were instructed in all sessions to make their estimates in 5mg increments.

In sessions 1-3, estimation and breath testing were carried out in a section of the experimental room apart from the drinking area, to ensure that subjects could not be influenced by hearing the estimates of others. In sessions 4 and 5 subjects returned individually to the experimental room used in sessions 1-3 to be breath tested.

2.9 ALCOHOL

The alcoholic beverage used in this study was commercial bottled beer (745ml bottles, 3.6% alcohol by volume).

Subjects were given an amount of beer calculated to

* Applicable to Group 1 (n=8) and Group 2 (n=8) for sessions 1, 2 and 3.
  Applicable to Group 3 (n=8) for sessions 1 and 3 only.

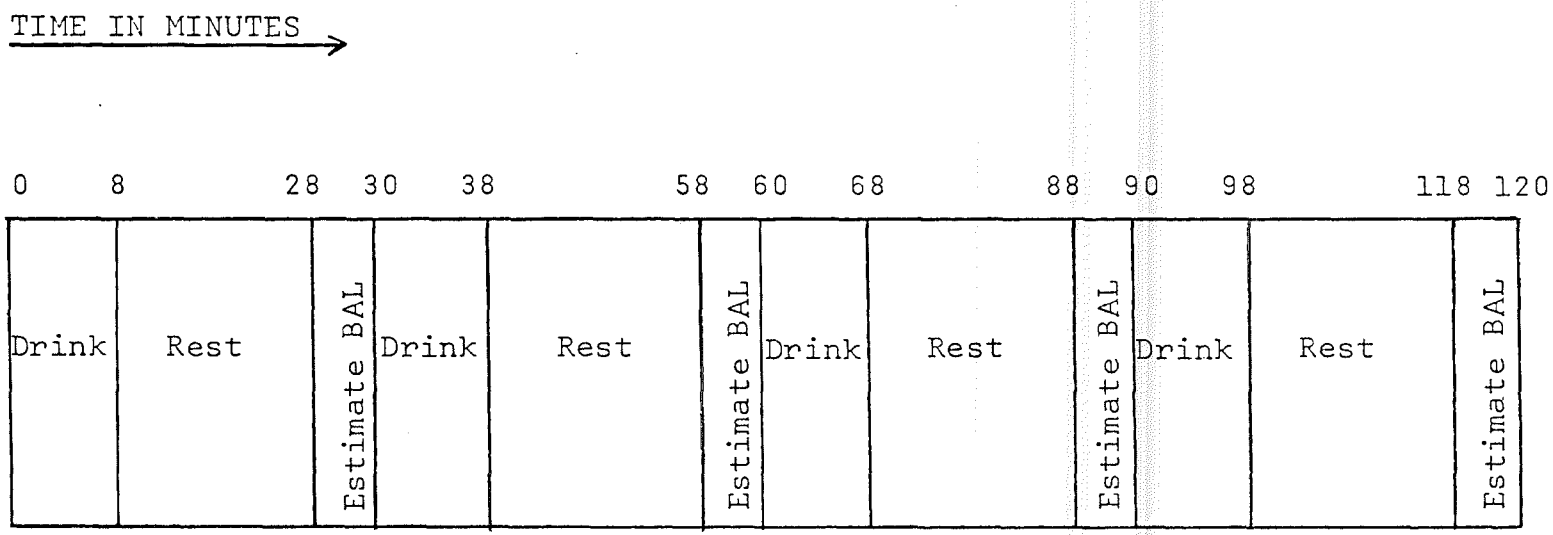


FIGURE 2. DRINKING AND BLOOD ALCOHOL LEVEL ESTIMATION SCHEDULE FOR SESSIONS 1, 2 AND 3 *

produce peak BALs of 70mg, 80mg and 90mg in sessions 1, 2 and 3 respectively. The required alcohol dose for each subject was generated by computer (see Appendix C).

In each of the first three sessions there were four eight minute drinking periods (see Figure 2). The overall session dose (in mls) was divided into four equal doses and one of these given to subjects during each of the four drinking periods. Subjects drank from standard hotel issue glasses (200mls).

Target BALs of 70mg, 80mg and 90mg were chosen because it was regarded as desirable to familiarise subjects with the BAL which constitutes the legal driving limit.

In sessions 4 and 5 individual subjects chose a target BAL between 40 and 70mg and drank beer at their own pace until they believed that this target had been reached.

2.10 DESCRIPTION OF EACH SESSION

Session 1 (Baseline)

This session provided baseline data, concerning pre-training BAL estimation ability.

All subjects received an amount of alcohol calculated to produce a peak BAL of approximately 70mg/100ml blood. The sequence of events for each subject was as follows: drink the beer provided (one quarter of the total dose) during an 8 minute period, then 20 minutes later estimate BAL and

give a breath sample. The 20 minute delay between drinking and testing allowed any residual mouth alcohol to dispurse, thus ensuring a valid breath alcohol analysis.

Immediately following the breath test the subject received another dose of beer and the same procedure was repeated. This cycle of events was repeated until the subject had made four BAL estimates and given four breath samples (see Figure 2).

Neither BAL feedback nor BAL discrimination training were given during this session.

Session 2 (Training)

Prior to this session three groups of eight subjects (four females, four males in each) matched on the basis of session 1 BAL estimation accuracy were formed by the experimenter.

Groups 1 and 2 both received discrimination training involving alcohol consumption, and feedback of actual BAL (verbal) after each estimate. Training for group 1 focused on internal cues while for group 2 training focused on both external and internal cues.

Group 3 received the same external and internal cue information as group 2, but no training involving alcohol consumption and BAL feedback was given.

For groups 1 and 2, the groups consuming alcohol, the drinking schedule was identical to that in session 1.

Group 1: Internal Cues Training

The aim was to train people in Group 1 to identify various BALs by learning to associate different body sensations with a particular alcolmeter reading.

During the four 20 minute waiting periods subjects were asked to focus on the subjective bodily sensations they were experiencing and write them down. They were told the association of particular sensations with a certain BAL would aid accurate BAL estimation.

A list giving examples of possible sensations was given to each subject to familiarise him/her with this concept. This list (see Appendix E) was based on symptoms described by subjects in a pilot study, and examples used in other studies (Bois & Vogel-Sprott, 1974; Ogurzsoff & Vogel-Sprott, 1976). Subjects were informed that the purpose of this list was to give them an idea of the type of symptoms they might experience. It was emphasised that because each person would probably experience sensations unique to themselves at different BALs, they should take note of their own sensations and not rely on those on the list. A table listing the kind of physical and psychological effects of different blood alcohol levels was also provided for subjects perusal (see Appendix F).

For subjects the difference between this session and session 1 was firstly that they now focused on and wrote down their subjective sensations during the 20 minute waiting periods,

and secondly that they received BAL feedback after each estimate.

Group 2: Combined External and Internal Cues Training

Subjects in Group 2 received the same instructions pertaining to internal cues as Group 1, plus an information pamphlet explaining external factors that can affect BALs. This pamphlet was designed to enable each subject to compute his/her approximate BAL based on knowledge of such factors as their own (approximate) rate of increase in BAL in relation to, time spent drinking and number of drinks consumed (see Appendix B).

A period of 20 minutes was allocated at the beginning of the session for subjects to read the pamphlet, answer the questions it contained, and ask any of their own. Training was begun when all subjects indicated they understood the pamphlet, and had demonstrated comprehension of it by way of their answers to the questions it contained.

The experimenters verbally emphasised the importance of paying attention to both internal and external cues, and taking both into account when making estimates. The sequence of events for this group was identical to that for Group 1.

Group 3: Information Only

Group 3 received the same information concerning external and internal cues as Group 2, with the exception that the rate of increase in BAL per hour contained in the pamphlet was not individualised for each subject according to height,

weight, and sex. Instead a standard rate of 10mg for males and 15mg for females was employed.

Training in the form of a drinking session with feedback of actual BAL was not provided. Instead subjects were present for a minimum of 30 minutes. During this time the concept of using internal and external cues to help one estimate BALs was explained, the internal sensations list read, the information pamphlet read and its questions answered. Subjects were allowed to leave when they indicated that they understood the information presented to them.

Session 3 (Testing)

This session provided a post training test of estimation accuracy in the training setting. Procedurally it was identical to session 1. Feedback of actual BAL was not given. All subjects were instructed to use the knowledge they had gained in the previous session when making their estimates.

Sessions 4 and 5 (Social Drinking)

In both of these sessions subjects drank in an actual bar environment, during one of the Student Union bar sessions.

For these sessions subjects first pre selected a BAL within specific limits (40-70mg). These particular limits were chosen because the majority of peak achieved BALs in sessions 1-3 fell in this range.

Subjects were then instructed to proceed to the bar to

drink and mix "as they normally would" in a social drinking situation, as the procedural constraints of sessions 1-3 would be absent. When subjects decided their target BAL had been reached they reported to the experimenters and drinking ceased. Following the 20 minutes waiting period, subjects were asked if their BALs were still at the target level. If the answer was no, they were asked to make another estimate based on how they presently felt. This was recorded along with the target BAL. An alcolsensor test followed. If a new estimate was made, this rather than the original target BAL was used in the data analysis.

Subjects received their instructions, chose a target BAL and gave the initial breath sample in one of the two rooms used for sessions 1-3. They then proceeded to the nearby bar and began drinking. Tickets supplied by the experimenters were used to purchase 745ml bottles of beer. This had previously been arranged with the Students Union management.

When testing was due subjects returned to the testing room individually with one of the experimenters, estimated their BAL if this was necessary, and were breath tested.

Actual BAL feedback was provided at the conclusion of session 5. Each subject also received a briefing on the changes in his/her estimation ability during the experiment, a computer generated personal BAL table (see Appendix C), and a handout concerning moderate drinking (see Appendix G).

CHAPTER 3

RESULTS

3.1 DATA ANALYSIS

The absolute difference between estimated and actual blood alcohol levels (absolute error of estimation) provided a measure of estimation accuracy.

Data analysis was carried out using a statistical software program (BMDP2V) developed by the Department of Biomathematics, University of California, Los Angeles. The BMDP2V program can execute an analysis of variance (ANOVA) for repeated measures designs with either equal or unequal cell sizes. Such an analysis was required for some data (Part B) because three subjects did not take part in session 5.

The data analysis will be considered in two parts:

Part A

This involved the data from sessions 1-3. For these sessions each subjects mean absolute error score per session (mean error score of the four estimates) was the measure of estimation accuracy subjected to analysis. The data for all 24 subjects was included.

Part B

In sessions 4 and 5 (drinking to a self selected target)

only one measure, that of peak (target) BAL estimation error was available for analysis. Peak error scores were however, also available for sessions 1-3 in terms of the final estimation error score.

Thus the data for Part B of the analysis was composed of each subjects peak BAL estimation error scores for all sessions (apart from session 2 for Group 3 subjects, who received information only during this session). The sessions 1-4 data for the three subjects absent from session 5 was excluded from this analysis.

3.2 ACHIEVED BLOOD ALCOHOL LEVELS

The alcohol dose subjects received in sessions 1, 2 and 3 was calculated to produce BALs of approximately 70mg, 80mg and 90mg respectively. The mean achieved BALs in these sessions however were, 51mg, 60mg and 59mg respectively. In session 1 the range of BALs was 35mg-65mg; in session 2 it was 50mg-75mg and in session 3, 45mg-70mg.

Sessions 4 and 5 (self selection of a BAL) produced mean achieved BALs of 56mg and 54mg respectively. The BAL ranges in these sessions were 35mg-80mg in session 4, and 30mg-105mg in session 5.

It is possible that any between group differences in achieved BALs could have a confounding effect on the results

of the experiment. No difference between groups in any session was revealed by analysis of variance. For groups 1, 2 and 3 in sessions 1, 3, 4 and 5; $F(2,15) = 0.53$. For groups 1 and 2 in all five sessions; $F(1,10) = 0.55$. Furthermore, there was no significant difference in achieved BALs between sessions. For sessions 1, 3, 4 and 5 all subjects included $F(3,45) = 2.51$. For all sessions, subjects in groups 1 and 2 included; $F(4,40) = 2.03$.

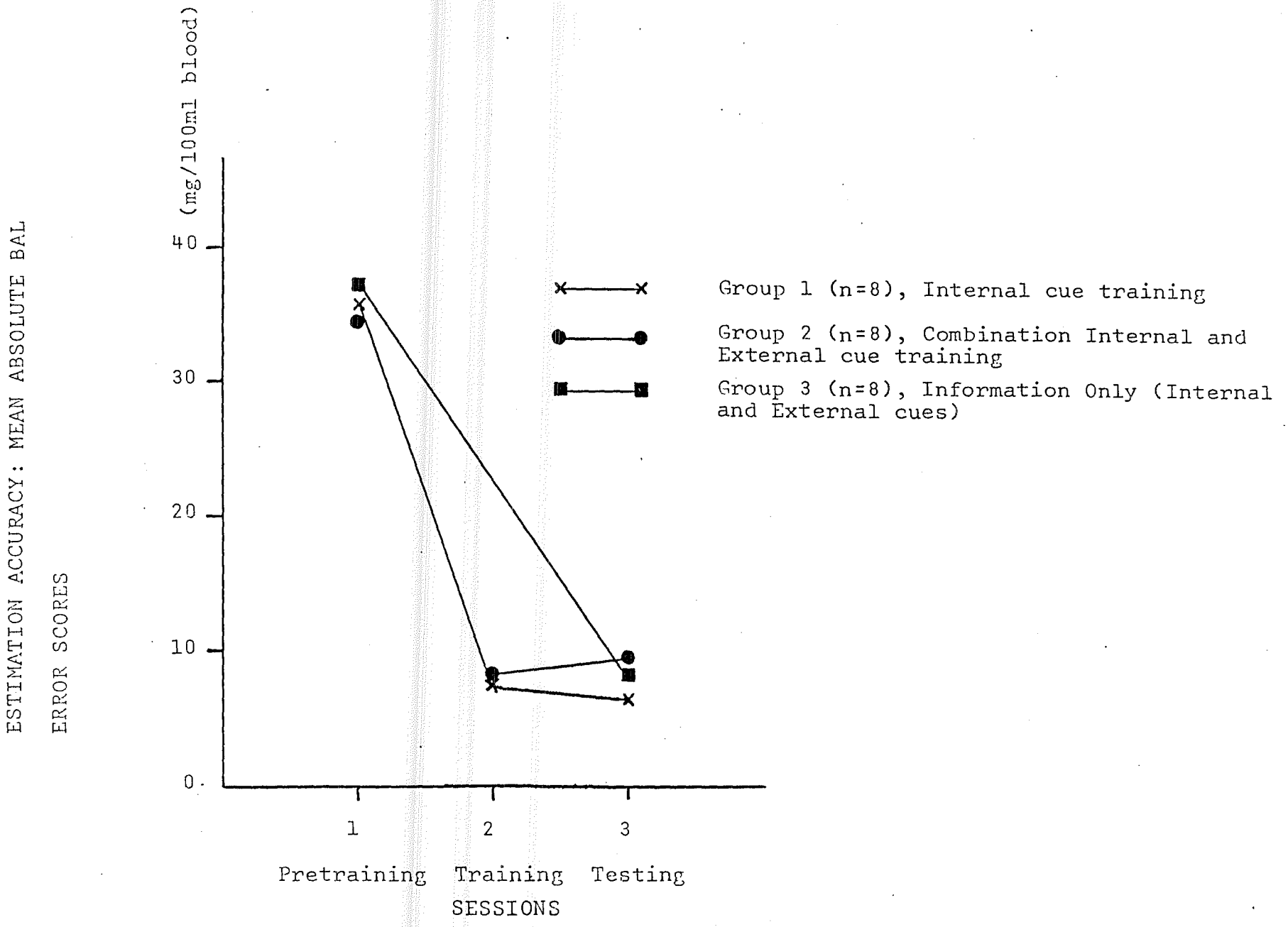


FIGURE 3. MEAN ABSOLUTE ERROR IN BLOOD ALCOHOL LEVEL ESTIMATES, OVER SESSIONS 1, 2 AND 3 FOR ALL 24 SUBJECTS

TABLE 1: ANALYSIS OF VARIANCE FOR REPEATED MEASURES.
MEAN BLOOD ALCOHOL LEVEL ESTIMATION ERROR SCORES,
SESSIONS 1 AND 3.
DATA FOR 24 SUBJECTS (ALL GROUPS) INCLUDED.

SOURCE	SS	df	MS	F	Prob.
G:GROUP	21.94010	2	10.97005	0.05	NS
S:SEX	0.52083	1	0.52083	0.00	NS
GS	35.61198	2	17.80599	0.08	NS
ERROR	3838.28125	18	213.23785		
R:SESSIONS	9422.00521	1	9422.00521	40.38	<.001
RG	49.67448	2	24.83724	0.11	NS
RS	10.54688	1	10.54688	0.05	NS
RGS	55.27344	2	27.63672	0.12	NS
ERROR	4200.00000	18	233.33333		

TABLE 2: ANALYSIS OF VARIANCE FOR REPEATED MEASURES.
MEAN BLOOD ALCOHOL LEVEL ESTIMATION ERROR SCORES,
SESSIONS 1, 2 AND 3.
DATA FOR ALL 16 SUBJECTS IN GROUPS 1 AND 2 INCLUDED

SOURCE	SS	df	MS	F	Prob.
G:GROUP	7.32422	1	7.32422	0.04	NS
S:SEX	3.93880	1	3.93880	0.02	NS
GS	9.40755	1	9.40755	0.05	NS
ERROR	2432.94271	12	202.74523		
R:SESSIONS	7952.92969	2	3976.46484	25.29	$<.001$
RG	42.38281	2	21.19141	0.13	NS
RS	49.67448	2	24.83724	0.16	NS
RGS	38.34635	2	19.17318	0.12	NS
ERROR	3772.91667	24	157.20486		

TABLE 3: DIFFERENCES AMONG SESSION MEAN BLOOD ALCOHOL LEVEL ESTIMATION ERROR SCORES: GROUPS 1 (n=8) AND 2 (n=8); SESSIONS 1, 2 AND 3.
PAIRWISE COMPARISONS WERE MADE USING A t TEST FORMULA FOR A REPEATED MEASURES SPLIT PLOT DESIGN.

	$\bar{X}_3$	$\bar{X}_2$	$\bar{X}_1$	
$\bar{X}_3$ = 7.9	-	.2	27.4	*
$\bar{X}_2$ = 8.1		-	27.2	*
$\bar{X}_1$ = 35.3			-	

* $p < .01$, two tailed.

3.3 BLOOD ALCOHOL LEVEL ESTIMATION

Part A Data: Mean Estimation Error: Sessions 1 - 3

Analysis of data for sessions 1 and 3 for all groups showed a significant main effect of sessions, $F(1,18) = 40.38$, $p < .001$, but there was no group or sex effect (see Table 1).

In order to include session 2 data a seperate analysis of sessions 1, 2 and 3 data for groups 1 and 2 was undertaken (see Table 2). It revealed a similar pattern: no group or sex differences were found, but there was a significant sessions effect, $F(2,24) = 25.29$, $p < .001$. The means and standard deviations for these two analyses are presented in Appendix H.

The significant reduction in mean error scores for all groups is clearly illustrated by the graph in Figure 3.

Due to the nature of these results the data for groups 1 and 2 was combined and sessions 1, 2 and 3 session means compared using a t test formula applicable to a split plot repeated measures design (Kirk, 1968). As Table 3 indicates there were significant differences between the session 1 mean error score and the session 2 and 3 mean error scores ($p < .01$, two tailed). No significant differences between session 2 and 3 mean error scores were observed.

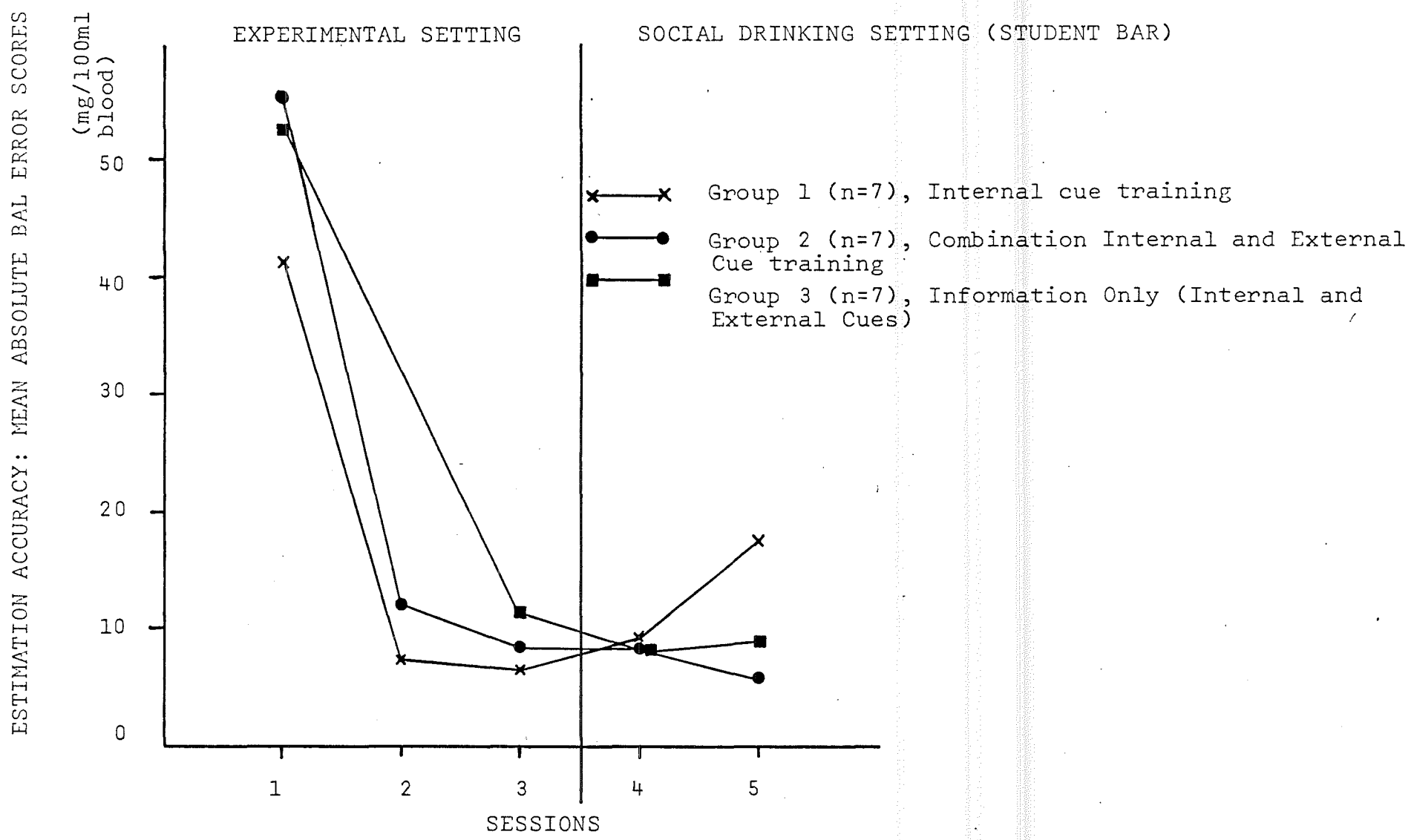


FIGURE 4. MEAN ABSOLUTE ERROR IN PEAK BLOOD ALCOHOL LEVEL ESTIMATES OVER ALL SESSIONS FOR 21 SUBJECTS.

TABLE 4: ANALYSIS OF VARIANCE FOR REPEATED MEASURES.
MEAN PEAK BLOOD ALCOHOL LEVEL ESTIMATION ERROR SCORES, SESSIONS 1, 3, 4 AND 5.
DATA FOR GROUPS 1, 2 AND 3 (21 SUBJECTS) INCLUDED.

SOURCE	SS	df	MS	F	Prob.
G:GROUP	72.37103	2	36.18552	0.20	NS
S:SEX	438.71528	1	438.71528	2.45	NS
GS	380.70437	2	190.35218	1.06	NS
ERROR	2685.93750	15	179.06250		
R:SESSIONS	25903.24901	3	8634.41634	38.65	<.001
RG	1569.89087	6	261.64848	1.17	NS
RS	222.29663	3	74.09888	0.33	NS
RGS	718.70040	6	119.78340	0.54	NS
ERROR	10053.64583	45	223.41435		

TABLE 5: DIFFERENCES AMONG SESSION MEAN PEAK BLOOD ALCOHOL LEVEL ESTIMATION ERROR SCORES: GROUPS 1 (n=7), 2 (n=7) AND 3 (n=7); SESSIONS 1, 3, 4 AND 5. PAIRWISE COMPARISONS WERE MADE USING A $\underline{t}$ TEST FORMULA FOR A REPEATED MEASURES SPLIT PLOT DESIGN.

	$\bar{X}_3$	$\bar{X}_4$	$\bar{X}_5$	$\bar{X}_1$	
$\bar{X}_3$ = 8.8	-	0	1.9	41.2	*
$\bar{X}_4$ = 8.8		-	1.9	41.2	*
$\bar{X}_5$ = 10.7			-	39.3	*
$\bar{X}_1$ = 50.0				-	

* $\underline{p} < .01$, two tailed

TABLE 6: ANALYSIS OF VARIANCE FOR REPEATED MEASURES.
MEAN PEAK BLOOD ALCOHOL LEVEL ESTIMATION ERROR SCORES, ALL SESSIONS.
DATA FOR GROUPS 1 AND 2 (14 SUBJECTS) INCLUDED.

SOURCE	SS	df	MS	F	Prob.
G:GROUP	80.47619	1	80.47619	0.37	NS
S:SEX	100.11905	1	100.11905	0.46	NS
GS	171.90476	1	171.90476	0.79	NS
ERROR	2170.83333	10	217.08333		
R:SESSIONS	17099.58333	4	4274.89583	21.62	<.001
RG	1440.65476	4	360.16369	1.82	NS
RS	256.72619	4	64.18155	0.32	NS
RGS	577.79762	4	144.44940	0.73	NS
ERROR	7908.33333	40	197.70833		

TABLE 7: DIFFERENCES AMONG SESSION MEAN PEAK BLOOD ALCOHOL LEVEL ESTIMATION ERROR SCORES: GROUPS 1 (n=7) AND 2 (n=7); SESSIONS 1, 2, 3, 4 AND 5. PAIRWISE COMPARISONS WERE MADE USING A t TEST FORMULA FOR A REPEATED MEASURES SPLIT PLOT DESIGN.

		$\bar{X}_3$	$\bar{X}_4$	$\bar{X}_2$	$\bar{X}_5$	$\bar{X}_1$	
$\bar{X}_3$ =	7.5	-	1.4	2.1	4.3	41.1	*
$\bar{X}_4$ =	8.9		-	0.7	2.8	39.6	*
$\bar{X}_2$ =	9.6			-	2.1	38.9	*
$\bar{X}_5$ =	11.8				-	36.8	*
$\bar{X}_1$ =	48.6					-	

* $p < .01$, two tailed

Part B Data: Mean Peak Blood Alcohol Level Estimation Error

Analysis of peak BAL estimation error scores in sessions 1, 3, 4 and 5 revealed a significant sessions effect, $F(3,45) = 38.65$, $p < .001$. No other effects were significant (see Table 4). The means and standard deviations for this data are presented in Appendix H.

Pairwise comparisons between session mean peak BAL estimation error scores, by t test (Kirk, 1968), indicated that there was a significant difference between session 1 peak error scores and those in sessions 3,4 and 5 ($p < .01$, two tailed). Session 3, 4 and 5 means were not significantly different from each other (see Table 5).

To include session 2 data in the analysis an ANOVA was carried out on groups 1 and 2 data for all 5 sessions. Again there was a significant sessions effect, $F(4,40) = 21.62$, $p < .001$, but no other effects were significant (see Table 6). The means and standard deviations for this data are presented in Appendix H.

Comparisons between session means for this data by t test also showed a significant difference between session 1 peak mean error scores and those in all other sessions ($p < .01$, two tailed). Mean peak error scores in sessions 2, 3, 4 and 5 did not differ significantly from each other (see Table 7). Figure 4 illustrates the reduction in mean peak error scores for each group across sessions.

A clear overall picture of the change in subjects estimation accuracy emerges when the findings of both parts A and B of the analysis are considered. Estimation accuracy increased dramatically with the advent of training in session 2 and remained at a similar level in session 3, as Figure 3 demonstates. This increased accuracy was retained not only in the experimental setting (sessions 1-3), but also in the social drinking environment of sessions 4 and 5, where the procedural constraints of sessions 1-3 were removed, subjects being allowed to mix freely and regulate their own alcohol intake (see Figure 4). Furthermore, accurate estimation ability was retained over the 15 week interval between sessions 4 and 5.

CHAPTER 4

DISCUSSION

This study investigated the effect of three methods of discrimination training on the ability of social drinkers to estimate blood alcohol levels.

The results demonstrate clearly the efficacy of these three forms of training. Although the range of individual estimation ability was wide, overall the three groups were initially poor judges of BALs, as shown by the high group mean error scores in session 1. With the introduction of discrimination training in session 2, group mean error scores decreased significantly and remained at a similarly low level in session 3, the testing session. Consequently, hypothesis one is supported.

Although the estimation ability of all three groups improved as a result of training, there was no difference between groups in that ability in the post training sessions. This finding is contrary to hypothesis two and of importance, in particular, because it indicates that an information package is equally as effective as training involving alcohol consumption.

The present study is unlike other investigations of discrimination training in that it examined the effect of an actual social drinking environment on estimation ability.

That the increased accuracy shown by all groups was maintained in the two bar drinking sessions is indicated by mean peak estimation error scores in sessions 4 and 5 which were significantly lower than those in session 1 and of a similar magnitude to those in sessions 2 and 3. Furthermore, it is clear that estimation accuracy can be maintained for at least 15 weeks, given the finding that there was no significant difference between the mean peak error scores for sessions 4 and 5. These findings provide support for hypothesis three.

Jones and Jones (1976) contend that there is little in the way of scientific data concerning the effects of alcohol on women. With regard to discrimination training, a survey of the literature reveals that this assertion cannot be denied. For this reason females were included in the present study and their estimation ability compared to that of the male subjects. No differences in the ability of males and females to estimate BALs either before or after training was found. Unfortunately, there is no other research to compare this finding with. Although there may be no such differences in estimation ability, it would be unwise to draw such a conclusion on the basis of this study alone, particularly in view of the small and homogeneous nature of the subject sample.

Although the results of the present investigation can be discussed in relation to other studies involving discrimination training, any comparisons must be tempered with awareness of the methodological differences between studies. For example, training methods vary from study to study; furthermore,

procedural variations abound. In the present study, the alcohol dosage received by subjects was not disguised; subjects were tested in groups; and an informal atmosphere encouraged during sessions 1-3. However, the way in which these components have been dealt with in other studies has varied. As mentioned previously these particular features were included in this study with the rationale that it is important to approximate a social drinking environment if generalisation to such a setting is desired.

Given such differences it can be stated that, in general, the results of this study are consistent with those of other experimental investigations involving social drinkers that demonstrate such subjects can be trained to estimate BAL accurately using either internal or external cues (e.g., Bois & Vogel-Sprott, 1974; Huber et al., 1976; Lipscomb & Nathan, 1980; Ogurzsoff & Vogel-Sprott, 1976).

The Maisto and Adesso (1977) finding that internal training did not lead to accurate BAL estimation is, however, contrary to both the present study and those mentioned above. As mentioned previously, it is likely that methodological issues (e.g., the demand characteristics, inherent in this experiment) contributed to this conflicting result.

Huber et al. (1976) examined the ability to estimate BALs when training involved either internal cues, external cues or a combination of both. These three methods were found to be equally effective in improving estimation accuracy.

The finding of no difference between the internal and external combination training methods in that study is supported by the results presented here.

It is unfortunate that due to experimenter error in the present study, the table illustrating typical physical and psychological effects of various BALs (see Appendix E), which Group 1 (internal training) received, inadvertently contained a reference to external factors. The possible confounding of this groups results must be acknowledged. It is conceivable that the estimation accuracy of Group 1 reflects not only internal training, but also this fortuitous exposure to an external factor affecting BALs, thus explaining the lack of difference between the results of groups 1 and 2. That this actually occurred is unlikely because subjects were instructed to rely solely on their internal sensations and when questioned about their method of estimation (see Appendix I), all indicated that they had relied on internal cues of intoxication.

It would seem then, a reliable finding that social drinkers can learn to estimate BALs accurately using either internal cue training, external cue training, or a combination of both. On the other hand, the efficacy of these forms of training in the treatment of alcohol abusers remains an area that is in need of clarification, as the present findings are not directly relevant to this question.

Although no difference was found in the effectiveness of the training methods used here, this writer considers that any applied use of discrimination training must include information relating to both internal and external cues, given that both are available in a social drinking environment.

The estimation accuracy demonstrated by subjects in this study, in and subsequent to the training sessions, is comparable to that achieved in several other investigations where estimation error within $\pm$ 10mg of the actual BAL has been noted (Bois & Vogel-Sprott, 1974; DeRicco, 1977; Ewing & Rouse, 1976; Huber et al., 1976; Lovibond & Caddy, 1970; Ogurzsoff & Vogel-Sprott, 1976; Vogler et al. 1975; Vogler et al. 1977b). In the case of Silverstein et al. (1974) estimation errors averaged 14mg after the first day of training, but did not drop below this level on subsequent days. Development of similar levels of accuracy in the present study required only one training session, as was also the case in several of those studies mentioned above (e.g., Bois & Vogel-Sprott, 1974; Huber et al., 1976; Ogurzsoff Vogel-Sprott, 1976). In the present study the session mean estimation error scores in sessions 2 and 3 were 8.1mg and 7.9mg respectively, as opposed to 35.9mg in session 1. Session mean peak estimation error scores in sessions 2,3,4 and 5 were 9.6mg, 8.8mg, 8.8mg and 7.9mg respectively, compared with 50mg in session 1. Clearly then, the training methods used here are as effective as those developed by other workers in the field.

One of the aims of this investigation was to provide subjects with practical knowledge that would be useful in their everyday lives. The experimenter was conscious of the possible benefits for people in being able to recognise when they have reached the legal driving limit and knowing how much alcohol would put them over this limit (80mg). Consequently in sessions 1, 2 and 3 target BALs of 70mg, 80mg and 90mg respectively were chosen with the hope of familiarising subjects with both the psychological and physiological sensations associated with the 80mg level.

A computer program (see Appendix C) was used to predict the alcohol dose required for each subject to achieve the above levels. By use of this program it was hoped to limit the variation in achieved BALs across subjects and groups, as such variations could affect interpretation of the results. In addition, this program generated hypothetical BAL charts for each subject taking into account number of drinks, time spent drinking and their individual height, weight and sex. In accord with the experimenter's objective of raising subjects' awareness of the actions of alcohol and of promoting responsible drinking behaviour, all subjects received their own personal BAL chart and a handout concerning guidelines for moderate drinking at the conclusion of the study. Informal discussion of the study with the subjects during the debriefing at the conclusion of session 5, revealed that in general they regarded what they had learnt as useful.

Mean achieved BALs in sessions 1, 2 and 3 fell below

the target BALs for those sessions. The reason for this is not clear. Maisto and Adesso (1977) have reported that failure to achieve predicted BALs in experimental settings is not unusual, as BALs are affected by a number of variables such as consumption rate and type of beverage, even if other variables are being held constant. Thus, it is likely that extraneous variables not under experimental control affected the level of achieved BALs. Possibly it was due to the fact that subjects food intake was not restricted beyond 2.5 hours. If subjects had eaten just prior to this time limit (and several indicated they had) any food in the stomach may have served to reduce peak BALs.

The use of computer generated alcohol doses, nevertheless did serve the main purpose of keeping between groups variability in achieved BALs to an acceptable level. No significant differences in BALs between groups in any session were demonstrated. In addition analysis showed that peak BALs did not vary significantly across sessions. However, subjects received BAL feedback only in session 2 and during the debriefing in session 5; furthermore, they were aware that they were to receive different amounts of alcohol in each session. Thus, it is unlikely the increase in estimation accuracy represents merely a reliance on recall of BALs achieved in session 2, rather than a training effect.

With regard to the aims of the present study the findings of most interest are that:

(a) the ability to estimate BAL accurately generalises to a social drinking environment.

(b) the ability to estimate BAL accurately in a social drinking environment is retained for some time (15 weeks).

(c) no difference in effectiveness between training involving drinking and that involving only an education component has been demonstrated.

The belief that discrimination training will facilitate accurate BAL estimation ability in the natural environment, and that this skill can be retained over time is crucial to the discrimination training paradigm. However, as far as the author is aware this assumption has remained untested until the present study when, in fact, it should have received careful scrutiny before the use of discrimination training, especially in treatment, was initiated.

The present study confirms the findings of Bois and Vogel-Sprott (1974) and Ogurzsoff and Vogel-Sprott (1976) that following training social drinkers can accurately monitor their own intake to achieve predetermined target BALs. More important, however, it shows that such people retain this ability in social drinking situations. Although this finding goes some way towardsvindicating the assumptions of other workers it does not justify the omission of research on this matter. Furthermore, it is not clear whether the present findings will also hold for alcohol abusers. Additional research will be necessary to answer this question.

The other central issue in this study was the utility of the information package Group 3 received. It has been suggested that development and maintenance of BAL estimation skill may be possible without training involving alcohol consumption (Caddy, 1978). This study is important in that it provides, to the author's knowledge the first direct test of this hypothesis. A comparison of Group 3 performance with that of groups 1 and 2 then, tests whether alcohol consumption and BAL feedback are necessary anchors for the internal and external cue information subjects in groups 1 and 2 received. (Ogurzsoff & Vogel-Sprott, 1976, note that BAL feedback has been proposed as the crucial element in discrimination training).

No difference between the training methods was demonstrated by the data analysis; indicating that alcohol consumption and BAL feedback are not essential to development of this skill. Although there are no directly relevant studies with which this finding can be compared, it is congruent with the results of Vogler et al. (1977b); Miller and Taylor (1980) and Miller et al. (1981), which indicate that with minimal therapist contact, education or information can change alcohol related behaviour in the desired direction. Again it cannot be assumed that this finding also extends to the ability of alcohol abusers to develop accurate estimation from an information package alone.

If information discrimination training packages are to be suitable for wide distribution, the use of standardised

rates of increase in BAL per hour (in relation to the number of drinks consumed), rather than individualised rates of increase would be appropriate. Thus the efficacy of using both types of rate of BAL increase was investigated in this study.

From the present findings, it is clear that in the information pamphlet, the use of a standard rate of increase in BAL per hour (in relation to the number of drinks consumed) for Group 3 as apposed to individualised rates for subjects in Group 2, was not detrimental to the estimation ability of Group 3.

Discrimination training is a complex procedure and expensive in terms of the equipment, time and personnel required to carry it out. Though by no means conclusive a finding such as that described here is of considerable importance in suggesting an equally effective alternative which is simpler and more cost effective.

In particular, this finding is relevant to the concepts of early intervention and prevention of alcohol abuse. Indeed with the inclusion of an informational discrimination training component in education and prevention campaigns a much wider audience could be secured than would be possible with the traditional training method. Such an application is directly relevant to the problem of drinking and driving, which has become an important social and health issue in New Zealand in recent years. It is now regarded as important that people

who drive know when to stop drinking, that is, know when they have reached the level where they are not capable of driving safely.

Brown (1980) and the New South Wales Bureau of Crime Statistics and Research, (1982) demonstrate the use of traditional discrimination training with persons convicted of 'drunk' driving. The present finding indicates that a much wider section of the community could be reached via informational discrimination training packages, in a simpler and more cost effective manner. Although the use of traditional discrimination training warrants further research, this writer is of the opinion that investigation of the application of informational packages in alcohol awareness and education programs should be a priority. If, on the other hand, the use of discrimination training in a treatment context is continued, it is this writer's view that it should be used as a complement to other treatment interventions, forming part of a multimodel approach where the emphasis is on developing alternatives to an abusive drinking style, rather than being used in isolation.

Although the present study is regarded as being of considerable importance to the discrimination training literature, further research will be necessary to test the generality of its findings. The subject sample used in the present study was unavoidably small and homogeneous in character (for economical and logistical reasons); furthermore,

only one type of alcoholic beverage was used. Though not of central interest, the reasons for the computer predicted BALs not being achieved also bears further consideration.

The experimental procedure could be improved by limiting the possibility of experimenter bias and by using experimenters naive to the specific purpose of such a study.

Due to subject availability in the post training sessions it was not always possible to have the testing subgroups composed of subjects who had all received the same training. Thus, it is possible that the internally trained subjects also received external cue information from subjects in the other two groups. This is unlikely, however, as subjects were instructed not to discuss matters relating to BAL estimation with each other, and they were closely supervised by the experimenters to ensure that this was the case. Nevertheless it is acknowledged that the present design could be strengthened by ensuring that testing subgroups are homogeneous. If, however, discrimination training was to be put to any applied use by the author, this factor would not be of concern, as training would focus on both external and internal cues.

Finally, when considering the utility of the discrimination training paradigm, one important issue must not be overlooked, and that is the effects of this type of training on future drinking behaviour (Ogurzsoff & Vogel-Sprott, 1976). Merely providing a person with such training does not guar-

antee that it will be put to constructive use; much depends on the motivation of the person concerned.

This is an issue which requires further investigation: although clinical studies to date (e.g., DeRicco, 1977; Lovibond & Caddy, 1970; Miller, 1978; Strickler et al., 1976; Vogler et al., 1975) illustrate that alcohol users can learn to estimate BAL accurately, they do not demonstrate conclusively that discrimination training was a factor in changing those subjects alcohol related behaviour. The impact of such knowledge on the drinking habits of both social drinkers and alcohol abusers is a factor which is central to the utility of discrimination training and thus merits attention.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

A general reinvestigation of the discrimination training paradigm was initiated bearing in mind unanswered questions in the literature relating to:

(a) the efficacy of external and internal training.
(b) the generalisation of discrimination training to social drinking situations.
(c) the retention of discrimination skill over time, particularly in relation to social drinking situations.
(d) the training environment.
(e) the lack of information pertaining to women and discrimination ability.
(f) the necessity of training involving alcohol consumption.

The present results support the contentions that both male and female social drinkers can be trained to estimate BALs accurately, and that this ability will generalise to and be retained over time in social situations. This result is important because generalisation to, and retention of discrimination skill in social situations are critical assumptions, but ones which have not been tested before the present study.

For the social drinkers in this study, three different training methods proved effective: Previous literature concerning the effectiveness of internal cue training, and combined

internal external cue training was supported. In addition, an information package containing information identical to that received by subjects exposed to training involving alcohol consumption and BAL feedback, but without these components, proved to be equally as effective as training involving these components.

The value of this finding in terms of reaching a wider section of the community than would be possible with traditional training in a simpler, more cost effective way is emphasised.

The present findings suggest several possibilities for further research, with regard to:

(i) women and alcohol related behaviour.

(ii) whether the present finding that, for social drinkers, the increase in estimation accuracy following traditional training is retained over time in a social situation, will also hold for alcohol abusers.

(iii) the efficacy of information discrimination training packages with alcohol abusers.

(iv) the effect of discrimination training on the subsequent drinking behaviour of those receiving such training.

For the author the area holding most promise for the application of discrimination training principles concerns prevention and alcohol education.

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APPENDIX A

QUESTIONNAIRE ON DRINKING BEHAVIOUR

Name: _____

This questionnaire will aid in the selection of subjects for an experiment investigating the ability of people to estimate their blood alcohol levels.

The information gathered will be regarded as confidential. Please answer every question and be as accurate as you can. If you have any questions, please ask the person administering the questionnaire.

SECTION A

1. How much do you normally drink each week?

   Beer _____

   Spirits _____

   Table Wine _____

   Fortified Wine _____

   Cocktails _____

2. Have you been in hospital more than once because of accidents? (by accidents we mean all types)

   _____

3. Have any close family members such as a parent brother, or sister, had drinking problems? _____

4. Do you drink before lunch fairly often? _____

5. After the first glass or two of alcohol do you ever feel a craving for more? _____

6. Are you preoccupied with thoughts about alcohol? _____

7. Do you sometimes drink alcohol even against your doctor's advice? _____

8. When you drink a lot of alcohol, do you tend to eat less? _____

9. Do you sometimes have feelings of nausea in the morning? _____

10. Have you found that your hands have been trembling a lot? _____

11. Have you ever tried to get rid of trembling or nausea with alcohol? _____

12. Have you ever been criticized at work because of your drinking? _____

13. Do you prefer to drink alone? _____

14. Do you think you're in worse shape because of your drinking? _____

15. Do you ever have a guilty conscience about drinking? _____

16. Have you ever felt it necessary to limit your drinking to certain occasions or to certain times of the day? _____

17. Do you feel you should drink less? _____

18. Do you think that without alcohol you would have fewer problems? _____

19. When you're upset do you drink alcohol to calm down? _____

20. Are there times when you'd like to stop drinking? _____

21. Would you get along better with your spouse/ partner/the people you're closest to if you didn't drink? _____

22. Have you ever deliberately tried to do without any alcohol at all? _____

23. Have you often been told that your breath smells of alcohol? _____

SECTION B

1. Where does the majority of your drinking take place? _____

2. How often during the week do you drink? _____

3. What is the average number of drinks you have on each occasion you drink? _____

4. Have you ever sought professional help for problems associated with alcohol? (If yes, specify problem and help sought). _____

_____

_____

5. Have you every sought help for problems of any other kind? _____

_____

_____

6. Has anyone ever confronted you with the possibility that you may have a drinking problem? _____

7. Are you currently taking any prescribed medication? _____

8. To your knowledge do you have any medical condition which could be adversely affected by the consumption of alcohol ? (e.g. diabetes, coronary disorder) _____

Thank you for your help.

NOTE 1: The source for section A of the questionnaire was the CAST, a questionnaire designed to aid in the detection of people with alcohol problems. This questionnaire was made available by the courtesy of G. Elvy of the Alcohol Research Unit, Christchurch Hospital (see Elvy & Wells, in press).

INFORMATION PAMPHLET

THE EFFECTS OF ALCOHOL

How much alcohol in popular sized drinks

Type	Pure alcohol strength by volume	Common serving size	Pure alcohol (approx. to nearest whole number)
Beer	approx 4%	200 mls	8 mls per glass or 40 mls per 1000 ml jug of beer or 30 mls per 750 ml bottle of beer
Light wines Sparkling and still table wines	approx 11%	90 mls	10 mls per glass or 82.5 mls per 750 ml bottle of wine
Fortified wines Sherry, port, etc	approx 18%	60 mls	11 mls per glass or 135 mls per 750 ml bottle
Spirits Gin, whisky, vodka, etc	approx 42%	20 mls (a nip)	8 mls per glass or 315 mls per 750 ml bottle

WHAT HAPPENS TO ALCOHOL WHEN IT IS CONSUMED:

Alcohol needs no digesting or breaking down. It passes through the wall of the stomach and small intestines into the bloodstream. From there it is carried to all parts of the body. A small proportion is removed from the body by the kidneys (urine) and the skin (perspiration) and the lungs (breathing). However 90% of the alcohol remains in the bloodstream until it is changed (metabolised) by the liver into energy.

The liver therefore has the most important role in processing alcohol in the body. It can metabolise about 10 mls of alcohol per hour. This is equivalent to one averaged size glass of drink according to the table shown.

INTOXICATION:

Intoxication begins immediately when alcohol is consumed faster than the body can dispose of it. If more than one drink is consumed in an hour the liver cannot metabolise it fast enough and it builds up in the bloodstream. This increases the effects on the brain causing intoxication.

The degree of intoxication depends of the concentration of alcohol in the blood.

BLOOD ALCOHOL LEVELS:

The amount of alcohol in the bloodstream is termed the blood alcohol level. The blood alcohol level is usually recorded in milligrams of alcohol per milliliter of blood. For example 80 mg is the legal driving limit.

ESTIMATION OF YOUR BLOOD ALCOHOL LEVELS:

Although many factors such as a persons weight, height and sex influence the rate of alcohol absorption into the body (and the resulting blood alcohol level), it is possible to estimate your blood alcohol level quite accurately if you know a few simple facts.

1. Normally a persons body can use up about one drink per hour that is, about one averaged size glass of drink as shown in Table I. For example if you have no more than one drink per hour your Blood Alcohol level at the end of that hour would still be around zero.

Let us look at another example;
Suppose you have already consumed some alcohol and your blood alcohol level is 60 mg. If you did not drink more than one drink each hour after this level was reached, your blood alcohol level would probably not rise above 60 mg.

2. If you have more than one drink an hour your blood alcohol level is likely to rise about _____ for each additional drink you have.
Thus two drinks in one hour would produce a blood alcohol level of approximately ___*___ .
Three drinks in one hour would produce a blood alcohol level of approximately ___*___ .
Four drinks in one hour would produce a blood alcohol level of approximately ___*___ .

3. Your blood alcohol level will decrease slowly at a constant rate of 15-20 mg per hour. This means that it would take you at least 4 hours to reach zero from the legal limit of 80 mg, if you drank no more.
From a blood alcohol level of 100 mg it would take at least ___*___ hours to reach zero blood alcohol level if you drank no more alcohol.

4. Blood alcohol levels are related to the amount of body water in an individual.
Because men have a larger amount of body water than women less alcohol is required to give the same blood alcohol level in a woman.

5. Women should be aware that their blood alcohol levels may vary in response to the same ammount of alcohol at different stages of their menstrual cycles.

6. Food also effects the rate at which alcohol is metabolised by decreasing the rate of alcohol absorption. If you eat before drinking or while drinking your blood alcohol level will only rise to a level about 1/2 - 2/3 of what it would be if you had no food in your stomach.
This should be considered on future drinking occasions when calculating your blood alcohol level from the information contained in this handout.

Taking all these factors into account we have prepared a chart which shows the effects varying amounts of alcohol are likely to have on you.

PSYCHOLOGICAL AND PHYSICAL EFFECTS OF ALCOHOL

NO. OF DRINKS IN 1 HOUR	BLOOD ALCOHOL LEVEL (mg)	TYPICAL PHYSICAL AND PSYCHOLOGICAL EFFECTS
	20 - 30	No overt effects, slight mood elevation and feeling of muscle relaxation.
	50 - 60	Feeling of relaxation and warmth. Slight decrease in muscle coordination and slight increase in reaction time.
	80 - 90	Feeling of euphoria. An increased loss of motor coordination. Slight impairment of balance, speech, vision and hearing.
	110 - 120	Mental faculties and judgement distinctly impaired. Maintenance of coordination and balance becoming difficult.
	140 - 150	Major impairment of mental and physical control. Lack of motor skill, blurred vision, slurred speech. Emotions disturbed. Reflexes slowed.
	200	Loss of motor control. Help needed to walk. Mental confusion. Senses distorted. Apathy. Loss of bladder control.
	300	Severe intoxication. Little conscious control of mind and body. Unconciousness possible.
	400	Unconciousness.
	500	Deep Coma.
	600	Death from respiratory failure.

NOTE: For each additional hour of drinking deduct 15 mg or one drink.

REMEMBER: The legal driving limit is 80 mg of alcohol per 100 ml of blood.

If you were drinking for a period of one hour how many drinks would be required to produce a blood alcohol level of:

50 mg _____*_____

80 mg _____*_____

If you were drinking over a period of two hours how many drinks would be required to produce a blood alcohol level of:

40 mg _____*_____

80 mg _____*_____

If you were drinking over a period of three hours how many drinks would be required to produce a blood alcohol level of:

30 mg _____*_____

80 mg _____*_____

INFORMATION PAMPHLET

NOTE 1: Blanks in the pamphlet denoted by an * were completed by subjects.

NOTE 2: The rate of increase in BAL per hour in relation to the number of drinks consumed (see, Estimation of your Blood Alcohol Levels, 2,) was individualised for subjects in Group 2. It was derived from their computer generated BAL tables. For subjects in Group 3 (information only) a standard figure of 10mg for males and 15mg for females was used.

NOTE 3: In the table entitled: Psychological and Physical Effects of Alcohol, the values in the first column (No. of drinks in 1 hour) were derived from the values given in statement 2 of the section entitled: Estimation of your Blood Alcohol Levels.

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APPENDIX C

A computer program to calculate Blood Alcohol Levels

Watson, Watson and Batt (1981) point out that in experimental studies involving alcohol consumption, the alcohol dose given to subjects is, "usually calculated in grams of alcohol per kilogram of body weight, with no correction for individual variations in the ratio of body fat to total body mass" (p.553-4).

Several discrimination training studies have used this method (eg., Bois & Vogel-Sprott, 1974; Lipscomb & Nathan, 1980; Maisto & Adesso, 1977; Ogurzsoff & Vogel-Sprott, 1976). Others, (eg., Huber et al. 1976; Lansky, Nathan, and Lawson, 1978), have given subjects a standardised alcohol dose. In the Huber et al. (1976) study subjects within a certain weight range were used to reduce variability in BALs.

However, even if subjects are approximately the same weight, such procedures can result in large variations in achieved BALs (Watson et al. 1981). It is possible that such variation could affect the results of discrimination training experiments (Maisto & Adesso, 1977).

Watson et al. (1981) indicate that more uniformity can be obtained using an equation, where grams of alcohol per litre of body water is used to calculate the required alcohol dose.

Limiting possible variation in achieved BALs in the present study was regarded as desirable. Thus such an equation (see Note 1) was the basis for a computer program which generated individualised BAL tables in relation to number of drinks consumed, drinking time, height, weight and sex.

BAL charts were produced for each subject and these used to determine the alcohol dose required in each of the first three sessions. Each subject received a copy of their personal BAL chart at the conclusion of the experiment.

The formulas and worked examples of such a BAL chart for a male and female are presented below.

FOR A MALE

Subject's Age = 23
Subject's Sex = M
Subject's Weight (kgs) = 73
Subject's Height (cm) = 177

Total Body Water (litres) = 43.81

Table of Blood Levels (mg/100mls)

Drink	Time Period (Hrs)					
#	0.5	1	1.5	2.0	2.5	3.0
**	***	***	***	***	***	***
1	4	0	0	0	0	0
2	14	7	1	0	0	0
3	24	18	11	5	0	0
4	34	28	21	15	8	2
5	45	38	32	25	19	12
6	55	48	42	35	29	22
7	65	59	52	46	39	33
8	75	69	62	56	49	43
9	86	79	73	66	60	53
10	96	89	83	76	70	63
11	106	99	93	86	80	73
12	116	110	103	97	90	84
13	126	120	113	107	100	94
14	137	130	124	117	111	104
15	147	140	134	127	121	114
16	157	151	144	138	131	125
17	167	161	154	148	141	135
18	178	171	165	158	152	145
19	188	181	175	168	162	155
20	198	192	185	179	172	166

FOR A FEMALE

Subject's Age = 23
Subject's Sex = F
Subject's Weight (kgs) = 51
Subject's Height (cm) = 160

Total Body Water (litres) = 27.58

Table of Blood Levels (mg/100mls)

Drink	Time Period (Hrs)					
#	0.5	1	1.5	2.0	2.5	3.0
**	***	***	***	***	***	***
1	10	3	0	0	0	0
2	26	19	13	6	0	0
3	42	36	29	23	16	10
4	58	52	45	39	32	26
5	75	68	62	55	49	42
6	91	84	78	71	65	58
7	107	101	94	88	81	75
8	123	117	110	104	97	91
9	140	133	127	120	114	107
10	156	149	143	136	130	123
11	172	166	159	153	146	140
12	188	182	175	169	162	156
13	205	198	192	185	179	172
14	221	214	208	201	195	188
15	237	231	224	218	211	205
16	253	247	240	234	227	221
17	270	263	257	250	244	237
18	286	279	273	266	260	253
19	302	296	289	283	276	270
20	318	312	305	299	292	286

NOTE 1: FORMULA FOR THE CALCULATION OF BLOOD ALCOHOL LEVELS

$$Ct = \left(\frac{A \times 0.8}{TBW} - 0.13t \right) 100$$

key Ct = the blood alcohol level at time t in mg/100ml

A = alcohol dose in grams (=5.6)

0.8 = average taken for fraction of water in blood

0.13t = average rate of alcohol metabolism

TBW = Total body water in litres

Note: A, 0.8, 0.13t are constants

References:

(a) P. Watson. Massey University.

Personal communications to:

(i) Dr. A. Metcalfe. University of Canterbury, August 20, 1981.

(ii) L. Prebble. University of Canterbury, June, 13, 1980.

(b) Watson, P.E., Watson, I.D. & Batt, R.D. (1981) Prediction of blood alcohol concentrations in human subjects. Journal of Studies on Alcohol, 42, 547-556.

NOTE 2: CALCULATION OF TOTAL BODY WATER (TBW).

Formula for Males:

$$TBW = 2.447 - 0.09516A + 0.1074 \text{ height} + 0.3362 \text{ weight}$$

Formula for Females:

$$TBW = -2.097 + 0.1069 \text{ height} + 0.2466 \text{ weight}$$

key: A = age in years

height = body height in cm

weight = body weight in kg

Reference:

Watson, P.E., Watson, I.D., & Batt, R.D. (1980). Total body water volumes for adult males and females estimated from simple anthropometric measurements. The American Journal of Clinical Nutrition, 33, 27-39.

THE PROGRAM

```
20      HOME : CLEAR
21      D$ = CHR$ (4)
25      DIM W(20,6)
30      INVERSE : PRINT "OPTIONS AVAILABLE": NORMAL
35      PT = 0
40      VTAB 8
50      PRINT " 1. ENTER DATA FOR A NEW SUBJECT"
60      PRINT
70      PRINT " 2. READ A FILE FROM DISK"
80      PRINT
90      PRINT " 3. CALCULATE A REQUIRED ALCOHOL DOSE"
100     PRINT
105     PRINT : PRINT " 4. SAVE THIS SUBJECTS DATA TO DISK"
110     PRINT : PRINT " 5. PRINT A COPY OF SUBJECT DATA"
115     PRINT : PRINT " 6. VIEW DATA FOR SUBJECT"
120     PRINT : PRINT " 7. QUIT": PRINT : PRINT
130     INPUT "TYPE NUMBER OF OPTION WANTED : ";A$
140     IF A$ = "1" THEN GOSUB 1000
150     IF A$ = "2" THEN GOSUB 6000
160     IF A$ = "3" THEN GOSUB 2000
161     IF A$ = "4" THEN GOSUB 5000
162     IF A$ = "5" THEN GOSUB 1500
163     IF A$ = "6" THEN GOSUB 1700
170     IF A$ = "7" THEN 8000
180     GOTO 30
1000    GOSUB 3000
1010    GOSUB 4000
1020    : PRINT "PRESS ANY KEY TO CONTINUE": GET A$: HOME :
        RETURN
```

```
1500   HOME : PRINT "TURN PRINTER ON"
1505   PT = 1
1510   PR# 2
1515   HOME
1520   GOSUB 7010
1530   PRINT : PRINT
1540   GOSUB 4080
1550   PT = 0: PR# 0
1560   HOME
1570   RETURN
1700   HOME : GOSUB 7010
1710   HOME : GOSUB 4080
1720   PRINT "PUSH ANY KEY TO CONTINUE": GET A$
1730   HOME : RETURN
2000   HOME
2010   PRINT
2020   PRINT "YOU MUST FIRST CALCULATE THE SUBJECT'S"
2025   PRINT "TOTAL BODY WATER": PRINT
2030   PRINT "THE COMPUTER WILL DO YOU THIS FOR YOU"
2040   PRINT "PRESS ANY KEY TO CALCULATE THIS": GET A$
2050   GOSUB 3000
2060   INPUT "WHAT IS THE BLOOD LEVEL YOU REQUIRE (MG/MLS) ?";
2070   INPUT "WHAT IS THE TIME INTERVAL INVOLVED (HRS) ?"; TI
2080   INPUT "DO YOU REQUIRE A PRINTOUT ON THE PRINTER Y/N?";A$
2085   HOME
2090   IF A$ = "Y" THEN PR#2
2100   PRINT "REQUIRED BLOOD LEVEL (MG/100MLS)= ";C
2110   PRINT "TIME PERIOD INVOLVED (HRS) = ";TI
2120   C = C / 100
```

```
2130    AG = (T / .8) * (C + .13 * TI)
2140    AG = AG + .005
2150    AG = 100 * AG
2160    AG = INT (AG)
2170    AG = AG / 100
2180    PRINT "REQUIRED DOSE IN GMS =";AG
2190    AG = AG / .789
2200    AG = AG + .005
2210    AG = 100 * AG
2220    AG = INT (AG)
2230    AG = AG / 100
2240    PRINT "REQUIRED DOSE IN MLS = ";AG
2250    PRINT : PRINT
2260    PR# 0
2280    PRINT "PUSH ANY KEY TO RETURN TO MENU"
2290    GET A$: HOME : RETURN
3000    HOME
3001    REM GET SUBJECT DATA
3002    REM CALCULATE TOTAL BODY WATER
3010    PRINT "THIS PROGRAM CALCULATES"
3020    PRINT "BLOOD ALCOHOL CONTENT & TOTAL BODYWATER"
3030    PRINT "(SEPERATELY FOR WOMEN AND MEN)"
3040    PRINT "ACCORDING TO TIME FACTORS"
3050    PRINT : PRINT
3060    PRINT "THE VARIABLES YOU REQUIRE ARE: 1. HEIGHT &
        WEIGHT OF SUBJECT 2. SEX 3. AGE 4. AMOUNT OF ALCOHOL
3070    PRINT : PRINT
3080    INPUT "WHAT IS SUBJECT'S AGE (YRS) ? ";A
3090    INPUT "WHAT IS SUBJECT'S SEX (M/F) ? ";S$
3100    INPUT "WHAT IS SUBJECT'S WEIGHT (KG'S) ?";W
```

```
3110    INPUT "WHAT IS SUBJECT'S HEIGHT (CM'S) ?";H
3170    T = 2.447 - .09516 * A + .10 74 * H + .3362 * W
3180    IF S$< >"F" THEN GOTO 3 200
3190    T = - 2.097 + .1069 * H + . 2466 * W
3200    V = T: GOSUB 9010
3210    T = V:
3220    GOSUB 7000
3240    RETURN
4000    HOME : PRINT "PLEASE WAIT, CALCULATING DATA"
4001    REM PRINT TABLE
4005    FOR 11 = 1 TO 20
4010    FOR 12 = 1 TO 6
4020    C = 11 * 5.6:TI = 12 * 5
4030    W(11,12) = (C - (.13 * TI * T) / .8) * .8 / T
4040    V = W(11,12): GOSUB 9000
4050    W(11,12) = V
4060    NEXT 12
4070    NEXT 11
4080    PRINT : PRINT "TABLE OF BLOOD LEVELS (MG/100MLS)":
        PRINT
4085    L = 0
4090    PRINT "DRINK" ;: HTAB (15): PRINT "TIME PERIOD (HRS)"
4100    PRINT "#";: HTAB (5): PRINT "0.5";: HTAB (10):
        PRINT "1";: HTAB (15): PRINT "1.5";: HTAB (20):
        PRINT "2.0";: HTAB (25): PRINT "2.5";: HTAB (30):
        PRINT "3.0"
4110    PRINT "** *** *** *** * ** *** ***"
4120    FOR 11 = 1 TO 20
4130    L = L + 1
```

```
4140    PRINT L;
4150    FOR 12 = 1 TO 6
4160    R = R + 5
4170    HTAB (R)
4180    IF W(11,12) < 0 THEN PRINT "0";: GOTO 4200
4190    PRINT 100 * W(11,12);
4200    NEXT 12
4210    PRINT " ": R=0
4220    NEXT 11
4230    RETURN
5000    HOME : VTAB 5: INPUT "WHAT FILE NAME : ";Z$
5001    REM WRITE DATA TO DISK
5010    PRINT D$; "OPEN";Z$
5020    PRINT D$; "WRITE";Z$
5030    PRINT T
5040    PRINT A
5050    PRINT H
5060    PRINT W
5070    PRING S$
5080    FOR 11 = 1 TO 20
5090    FOR 12 = 1 TO 6
5100    PRINT W(11,12)
5110    NEXT 12
5120    NEXT 11
5130    PRINT D$; "CLOSE";Z$
5140    PRINT : PRINT : PRINT : PRINT
        "DATA HAS BEEN SAVED AS ";Z$
5150    FOR J = 1 TO 1000: NEXT J: HOME : RETURN
6000    HOME : VTAB 5
```

```
6001   REM READ DATA FROM DISK
6010   INPUT "WHAT IS THE FILE NAME?";Z$
6020   PRINT D$; "OPEN";Z$
6030   PRINT D$; "READ";Z$
6040   INPUT T
6050   INPUT A
6060   INPUT H
6070   INPUT W
6080   INPUT S$
6090   FOR 11 = 1 TO 20
6100   FOR 12 = 1 TO 6
6110   INPUT W(11,12)
6120   NEXT 12
6130   NEXT 11
6140   PRINT D$; "CLOSE";Z$
6150   PRINT : PRINT "OK DATA HAS BEEN READ"
6160   FOR J = 1 TO 1000: NEXT J: HOME : RETURN
7000   HOME : VTAB 5
7001   REM PRINT SUBJECT DATA
7010   PRINT "SUBJECT'S AGE= ";A
7020   PRINT "SUBJECT'S SEX = ";S$
7030   PRINT "SUBJECT'S WEIGHT (KGS)=";W
7040   PRINT "SUBJECT'S HEIGHT (CM) = ";H
7050   PRINT : PRINT
7060   PRINT "TOTAL BODY WATER (LITRES) = ";T
7065   IF PT = 1 THEN RETURN
7070   PRINT : PRINT : PRINT "PRESS ANY KEY TO CONTINUE
7080   GET A$: RETURN
8000   HOME : PRINT "FINISHED": END
```

```
9000    REM ROUNDING SUBROUTINE
9010    V = .005 + V
9020    V = 100 * V
9030    V = INT (V)
9040    V = (V / 100)
9050    RETURN
```

This program created by Mike Lance.

APPENDIX D

PHOTO OF STUDENT BAR

The photo below shows one of the student bars at which the drinking in sessions 4 and 5 took place.

APPENDIX E

POSSIBLE PSYCHOLOGICAL AND PHYSICAL EFFECTS OF MODERATE AMOUNTS OF ALCOHOL

Here are some examples to indicate the kind of sensations you might experience when drinking moderate amounts of alcohol:

Legs feel weak
Tight forehead
Lips are numb
Front teeth numb
Head cloudy
Wooliness in head
Light headed
Flushed feeling

Relaxed
Happy
Less inhibited
Euphoric

APPENDIX F

PSYCHOLOGICAL AND PHYSICAL EFFECTS OF ALCOHOL

BLOOD ALCOHOL LEVEL (mg)	TYPICAL PHYSICAL AND PSYCHOLOGICAL EFFECTS
20 - 30	No overt effects, slight mood elevation and feeling of muscle relaxation.
50 - 60	Feeling of relaxation and warmth. Slight decrease in muscle coordination and slight increase in reaction time.
80 - 90	Feeling of euphoria. An increased loss of motor coordination. Slight impairment of balance, speech, vision and hearing.
110 - 120	Mental faculties and judgement distinctly impaired. Maintenance of coordination and balance becoming difficult.
140 - 150	Major impairment of mental and physical control. Lack of motor skill, blurred vision, slurred speech. Emotions disturbed. Reflexes slowed.
200	Loss of motor control. Help needed to walk. Mental confusion. Senses distorted. Apathy. Loss of bladder control.
300	Severe intoxication. Little conscious control of mind and body. Unconciousness possible.
400	Unconciousness
500	Deep Coma
600	Death from respiratory failure

* NOTE: For each additional hour of drinking deduct 15 mg or one drink.

REMEMBER: The legal driving limit is 80 mg of alcohol per 100 ml of blood.

NOTE 1:

Unfortunately, due to experimenter error, the table presented above, which subjects in Group 1 (internal cue training) received contains a reference to external cues.

While it is acknowledged that this error could have confounded the results of Group 1 by making some external cues salient, it is unlikely that this occurred.

Subjects were instructed to rely solely on their internal sensations when estimating BAL, and when questioned about their method of estimation, all indicated that they had relied on internal sensations. Furthermore, the information package necessary to provide context and meaning for the misplaced statement was not available to subjects in Group 1.

The statement in question is marked by an *

NOTE 2:

This table adapted from:
Girdano, D.A. & Dusek, D. (1980). Drug Education, content and methods. California: Addison-Wesley. (p.71).

APPENDIX G

GUIDELINES FOR MODERATE DRINKING

I. When, what

1. Drink only in social settings, with other people - avoid becoming drunk alone.
2. Wait until after work before having a drink; never drink in the morning.
3. Drink only at mealtime or in the evening at parties.
4. During a meal, a glass of beer or wine is O.K. - not spirits.
5. Spirits are drunk only before a meal, or at a party.
6. Drink only beer, wine or mixed drinks - avoid straight drinks.
7. Avoid drinking when you are upset, anxious, worried or angry. Find someone to talk to instead.

II. How, How Much

1. Take at least 20-30 minutes to finish a drink.
2. Make a drink last for at least 6 sips.
3. Pause for a while between sips.
4. When you finish a drink, wait 15 minutes before starting another.
5. Limit yourself to 2 drinks a meal.
6. Limit yourself to 2 drinks per hour at a party, and less if it is a long party - say, 5 drinks per 3 hours, or 6 drinks per 4 hours.
7. At parties, eat something along with drinking.
8. Avoid drinking at parties more than 2 or 3 nights per week.

9. Learn how to say "no" when offered a drink, or when someone really tries to talk you into drinking.
10. If you are partying, drink an occasional glass of water or soda; it gives you something to sip while helping to space out your drinks.

APPENDIX H

TABLES OF MEANS AND STANDARD DEVIATIONS

TABLE 1: MEANS AND STANDARD DEVIATIONS FOR PART A DATA (N=24)

	SESSIONS		
	1	2	3
GROUP 1 (n=8)			
Males (n=4)			
M	34.1	9.4	6.2
SD	27.0	5.8	1.8
Females (n=4)			
M	37.8	6.6	6.2
SD	18.7	2.1	1.8
GROUP 2 (n=8)			
Males (n=4)			
M	34.4	8.1	12.2
SD	21.2	5.1	6.1
Females (n=4)			
M	35.0	8.4	6.9
SD	20.1	1.2	4.8
GROUP 3 (n=8)			
Males (n=4)			
M	38.4		7.2
SD	10.9		5.6
Females (n=4)			
M	36.2		9.0
SD	22.5		4.1

TABLE 2: MEANS AND STANDARD DEVIATIONS FOR PART B DATA (N=21)

	SESSIONS				
	1	2	3	4	5
GROUP 1 (n=7)					
Males (n=3)					
M	36.7	8.3	8.3	10.0	16.7
SD	33.3	10.4	5.8	5.0	15.3
Females (n=4)					
M	45.0	6.2	5.0	8.7	18.7
SD	16.8	2.5	4.1	11.1	10.3
GROUP 2 (n=7)					
Males (n=3)					
M	66.7	10.0	15.0	11.7	3.3
SD	25.2	8.7	5.0	7.6	2.9
Females (n=4)					
M	47.5	13.7	3.7	6.2	7.5
SD	34.3	4.8	2.5	6.3	6.4
GROUP 3 (n=7)					
Males (n=3)					
M	61.7		10.0	15.0	11.7
SD	22.5		8.7	5.0	11.5
Females (n=4)					
M	46.2		12.5	3.7	6.2
SD	19.3		11.9	4.8	2.5

APPENDIX I

QUESTIONING OF SUBJECTS ABOUT THEIR METHODS OF BLOOD ALCOHOL LEVEL ESTIMATION

Subjects were questioned about their method of estimation at the end of all sessions. In sessions 2,3,4 and 5 all subjects indicated that they had used the specific training they had been given to estimate BAL. From the questioning at the end of session 1 it was evident that in general subjects had no systematic method for estimation of BALs in this session. Instead they typically attempted to use their belief of what the legal driving limit level of intoxication would feel like as a guide, and guessed.

APPENDIX J

DATA

DATA 1: Part A Results; Mean Blood Alcohol Level Estimation Error Scores.

		SESSIONS		
		1	2	3
GROUP 1				
	Males	3.75	1.25	5
		26.25	11.25	6.25
		37.5	15	5
		68.75	10	8.75
	Females	12.5	8.75	6.25
		35	6.25	5
		50	7.5	8.75
		53.75	3.75	5
GROUP 2				
	Males	8.75	5	8.75
		30	8.75	21.25
		38.75	3.75	8.75
		60	15	10
	Females	7.5	7.5	5
		32.5	10	13.75
		50	8.75	6.25
		50	7.5	2.5
GROUP 3				
	Males	26.25		15
		35		7.5
		40		2.5
		52.5		3.75
	Females	7.5		13.75
		32.5		6.25
		43.75		5
		61.25		11.25

DATA 2: Part B Results; Mean Peak Blood Alcohol Level Estimation Error Scores.

		SESSIONS					
		1	2	3	4	5	
GROUP 1							
	Males	0	0	15	15	0	
		45	5	5	10	30	
		65	20	5	5	20	
		85	5	20	10	-	*
	Females	25	10	0	5	30	
		40	5	5	5	20	
		65	5	10	25	20	
		50	5	5	0	5	
GROUP 2							
	Males	20	0	0	0	-	*
		40	5	15	20	5	
		70	5	10	10	0	
		90	20	20	5	5	
	Females	0	15	5	15	5	
		45	10	5	5	10	
		70	20	5	5	15	
		75	10	0	0	0	
GROUP 3							
	Males	35		10	10	-	*
		60		20	20	25	
		40		5	15	5	
		85		5	10	5	
	Females	25		30	0	5	
		35		10	10	5	
		60		5	0	10	
		65		5	5	5	

* This data excluded from the statistical analysis.

DATA 3: Achieved Blood Alcohol Levels

		SESSIONS					
		1	2	3	4	5	
GROUP 1							
	Males	50	65	55	70	60	
		45	60	65	65	45	
		45	55	60	50	45	
		65	10	60	70	-	*
	Females	60	60	60	65	105	
		50	55	50	55	50	
		50	50	65	75	60	
		50	60	55	55	55	
GROUP 2							
	Males	55	55	50	40	-	*
		60	65	45	80	65	
		50	60	60	40	50	
		55	60	65	50	55	
	Females	60	55	50	60	35	
		55	75	70	50	60	
		45	65	65	55	30	
		35	50	45	40	40	
GROUP 3							
	Males	40		55	60	-	*
		60		60	75	75	
		50		60	65	55	
		45		65	45	45	
	Females	50		55	40	50	
		50		55	35	35	
		60		65	60	55	
		55		70	50	65	

* This data excluded from the statistical analysis.